



UNIVERSIDADE FEDERAL DE CAMPINA GRANDE
CENTRO DE ENGENHARIA ELÉTRICA E INFORMÁTICA
Programa de Pós-Graduação em Ciência da Computação

TESE DE DOUTORADO

Agile Leadership in Software Development Teams: A Perspective on
the Differences Between Leaders and Non-Leaders

Narallynne Maciel de Araújo

Campina Grande, Paraíba, Brasil
Fevereiro/2025

Universidade Federal de Campina Grande
Centro de Engenharia Elétrica e Informática
Programa de Pós-Graduação em Ciência da Computação

Agile Leadership in Software Development Teams:
A Perspective on the Differences Between Leaders
and Non-Leaders

Narallynne Maciel de Araújo

Tese submetida à Coordenação do Curso de Pós-Graduação em Ciência da Computação da Universidade Federal de Campina Grande (Campus I) como parte dos requisitos necessários para obtenção do grau de Doutora em Ciência da Computação.

Área de Concentração: Ciência da Computação

Linha de Pesquisa: Aspectos Humanos em Engenharia de Software

Dr. Tiago Lima Massoni
(Orientador)

Campina Grande, Paraíba, Brasil

©Narallynne Maciel de Araújo, 2025

A663a Araújo, Narallynne Maciel de.
Agile leadership in software development teams : a perspective on the differences between leaders and non-leaders / Narallynne Maciel de Araújo. – Campina Grande, 2025.
151 f. : il. color.

Tese (Doutorado em Ciência da Computação) – Universidade Federal de Campina Grande, Centro de Engenharia Elétrica e Informática, 2025.
"Orientação: Prof. Dr. Tiago Lima Massoni".
Referências.

1. Engenharia de Software. 2. Equipes de Desenvolvimento de Software. 3. Liderança. 4. Liderança Ágil. I. Massoni, Tiago Lima. II. Título.

CDU 004.41(043)



MINISTÉRIO DA EDUCAÇÃO
UNIVERSIDADE FEDERAL DE CAMPINA GRANDE
POS-GRADUACAO EM CIENCIA DA COMPUTACAO
Rua Aprígio Veloso, 882, Edifício Telmo Silva de Araújo, Bloco CG1, - Bairro Universitário, Campina Grande/PB, CEP 58429-900
Telefone: 2101-1122 - (83) 2101-1123 - (83) 2101-1124
Site: <http://computacao.ufcg.edu.br> - E-mail: secp@computacao.ufcg.edu.br

FOLHA DE ASSINATURA PARA TESES E DISSERTAÇÕES

NARALLYNNE MACIEL DE ARAÚJO

AGILE LEADERSHIP IN SOFTWARE DEVELOPMENT TEAMS: A PERSPECTIVE ON THE DIFFERENCES BETWEEN LEADERS AND NON-LEADERS

Tese apresentada ao Programa de Pós-Graduação em Ciência da Computação como pré-requisito para obtenção do título de Doutor em Ciência da Computação.

Aprovada em: 27/02/2025

Prof. Dr. **Tiago Lima Massoni**, UFCG, Orientador

Prof. Dr. **Wilkerson de Lucena Andrade**, UFCG, Examinador Interno

Profa. Dra. **Lívia Maria Rodrigues Sampaio Campos**, UFCG, Examinadora Interna

Prof. Dr. **Davi Viana dos Santos**, UFMA, Examinador Externo

Profa. Dra. **Edna Dias Canedo**, UnB, Examinadora Externa



Documento assinado eletronicamente por **Davi Viana dos Santos, Usuário Externo**, em 06/03/2025, às 11:35, conforme horário oficial de Brasília, com fundamento no art. 8º, caput, da [Portaria SEI nº 002, de 25 de outubro de 2018](#).



Documento assinado eletronicamente por **WILKERSON DE LUCENA ANDRADE, PROFESSOR(A) DO MAGISTERIO SUPERIOR**, em 06/03/2025, às 11:36, conforme horário oficial de Brasília, com fundamento no art. 8º, caput, da [Portaria SEI nº 002, de 25 de outubro de 2018](#).



Documento assinado eletronicamente por **EDNA DIAS CANEDO, Usuário Externo**, em 06/03/2025, às 11:54, conforme horário oficial de Brasília, com fundamento no art. 8º, caput, da [Portaria SEI nº 002, de 25 de outubro de 2018](#).



Documento assinado eletronicamente por **TIAGO LIMA MASSONI, PROFESSOR(A) DO MAGISTERIO SUPERIOR**, em 07/03/2025, às 07:22, conforme horário oficial de Brasília, com fundamento no art. 8º, caput, da [Portaria SEI nº 002, de 25 de outubro de 2018](#).



Documento assinado eletronicamente por **LIVIA MARIA RODRIGUES SAMPAIO CAMPOS, PROFESSOR(A) DO MAGISTERIO SUPERIOR**, em 07/03/2025, às 10:07, conforme horário oficial de Brasília, com fundamento no art. 8º, caput, da [Portaria SEI nº 002, de 25 de outubro de 2018](#).



A autenticidade deste documento pode ser conferida no site <https://sei.ufcg.edu.br/autenticidade>, informando o código verificador **5274996** e o código CRC **6F2302C9**.

Acknowledgments - in portuguese

A Deus, Pai, Mãe, Divina Consciência, pela vida e pelo agora, e a toda a espiritualidade de luz que me acompanha e me inspira.

Aos meus pais, Fernando e Elza, por todo o amor, pelo ensino dos bons valores e, principalmente, por não medirem esforços pela minha educação.

À minha irmã, Naryllenne, também pesquisadora, agradeço por todo o incentivo, suporte e tempo dedicado a me ouvir e se fazer presente.

Ao meu parceiro de vida, Arthur, agradeço por não ter soltado a minha mão durante esses últimos cinco anos de luta. Seu companheirismo, carinho e compreensão foram fundamentais.

À minha psicóloga, Rayssa, por me ajudar a controlar a ansiedade, a desacelerar os meus pensamentos e a reaprender a me tratar de forma gentil. Seu apoio foi fundamental para a conclusão deste trabalho.

Ao meu orientador, Prof. Massoni. Digo a todos o quanto tive a sorte de encontrar um orientador tão empático, gentil e humano. Todas as nossas vivências me inspiram não apenas para a carreira que escolhi seguir, mas também para a vida.

Aos professores da banca examinadora: Prof. Davi Viana (UFMA), Prof^a. Edna Canedo (UnB), Prof. Wilkerson Andrade (UFCG) e Prof^a. Lívia Campos (UFCG). Agradeço pelas contribuições indispensáveis para a versão final desta tese.

Aos professores que tive/tenho a honra de trabalhar em projetos de PD&I: Dalton, João Arthur, Manel, Fábio, Franklin e Jorge. Admiro e me inspiro muito em cada um.

Às amigas, amigos e colegas que a UFCG me presenteou: Sheila, Victor, Rodrigo, Ruan, Manoel, Iann, Helen, Bia, Drica, Nicolas, Cilas, Mariane, Abraão, Ingrid, Carmelita, João Pedro, Mayara, Júlia, Guilherme, Marcelo, Bianca, Carol, José Truta, Walber, Paulo, Stefane, Vinicius, Elaine, Hanna, Camila, Danielly, Lilian, Paloma, D. Marilene e Cleide. Cada um(a), de forma direta ou indireta, me ajudou em algum momento dessa jornada e a vocês eu serei para sempre grata.

À todas as outras amigas e amigos que torceram e torcem por mim, muito obrigada!

*“Que em tempos de tecnologias digitais
e inteligências artificiais, nunca nos
falte, como pessoas pesquisadoras da
computação, a sensibilidade que
preserva nossa essência humana.”*

Prof^ª. Dr^ª. Sheila Reinehr

Resumo

Apesar da considerável quantidade de pesquisas sobre liderança ágil em equipes de desenvolvimento de software, grande parte da literatura foca exclusivamente na perspectiva dos líderes. Estudos anteriores mostram que, para os líderes, a liderança ágil é um processo compartilhado, dinâmico e colaborativo. No entanto, há uma lacuna na compreensão de como os desenvolvedores que não ocupam cargos de liderança percebem essa abordagem, considerando que o conceito ágil visa à autogestão das equipes. Isso levanta questões sobre como líderes e não-líderes percebem e compartilham a liderança, influenciando diretamente colaboração, comunicação, motivação e eficiência dos processos. Investigar essas perspectivas pode revelar pontos de convergência e divergência que afetam o alinhamento da equipe e a melhoria dos processos ágeis. Assim, esta tese busca identificar e avaliar como líderes e não-líderes percebem a liderança ágil, aprimorando práticas de liderança em contextos ágeis. Para isso, foram conduzidos dois estudos complementares: um estudo de caso qualitativo com duas equipes de desenvolvimento, analisando diferenças na percepção de liderança, e uma abordagem quantitativa para testar hipóteses e identificar correlações entre estilos de liderança e atribuição de responsabilidades. Os resultados indicam que, enquanto os líderes percebem a liderança como compartilhada e colaborativa, os não-líderes frequentemente a veem como individual e hierárquica. Além disso, fatores como tempo de equipe, experiência técnica, tamanho da equipe e aptidão influenciam a distribuição da liderança. Para triangular os dados e complementar o estudo qualitativo, a abordagem quantitativa examinou diferenças nos fatores de atribuição de liderança e nas situações em que essa atribuição ocorre para líderes e não-líderes. Entre as principais contribuições, esta tese propõe recomendações para aprimorar práticas ágeis, promover colaboração e alinhar expectativas entre líderes e não-líderes, aumentando a eficiência dos processos e a qualidade dos produtos de software.

Palavras-chave: equipes de desenvolvimento de software; liderança; liderança ágil; engenharia de software; não-líderes; líderes.

Abstract

Despite a considerable amount of research aimed at understanding agile leadership in software development teams, much of the existing literature focuses exclusively on the perspective of leaders. Previous research has shown that, for leaders, agile leadership is a shared, dynamic, and collaborative process that promotes belonging and cultural integration. However, there is a gap in understanding how developers who do not occupy leadership positions perceive this approach since the agile concept aims at self-management and self-organization of software engineering teams. This raises important questions about how leaders and non-leaders perceive and share agile leadership. Understanding these differences is essential because leadership perceptions directly influence collaboration, communication, motivation, and efficiency of software products and processes. Investigating these perspectives helps identify points of convergence and divergence that affect team alignment, contributing to the improvement of agile processes. Thus, the main objective of this thesis is to evaluate how leaders and non-leaders perceive agile leadership, improving leadership processes and practices in agile contexts. To this end, two complementary studies were conducted using qualitative and quantitative approaches. The first was a case study with two development teams, investigating differences in leadership perception. The results indicate that while leaders perceive leadership as shared and collaborative, non-leaders often see it as individual and hierarchical. In addition, factors such as team tenure, technical experience, team size, and aptitude influence leadership distribution. Then, to triangulate the data and complement the case study, the quantitative approach tested hypotheses and identified correlations between leadership styles and assignment responsibilities, as well as differences between leadership assignment factors and situations in which this assignment occurs. Among the main contributions, this thesis proposes recommendations to improve agile practices, promote collaboration, and align expectations between leaders and non-leaders to increase process efficiency and software product quality.

Keywords: software development teams; leadership; agile leadership; software engineering; non-leaders; leaders.

List of Figures

1.1	ABC Framework - Qualitative Study - Stol and Fitzgerald (2020).	8
1.2	ABC Framework - Quantitative Study - Stol and Fitzgerald (2020).	10
1.3	Design of the Study.	11
3.1	Case Study Design - Adapted from Yin (2009).	25
3.2	Team A agile process	27
3.3	Team B agile process	29
3.4	Data collection and analysis	30
3.5	Non-Leaders' and Leaders' Perspectives on Leadership.	33
4.1	Data Collection and Analysis	48
4.2	Leadership Indexes Classification	59
4.3	Vignettes comparisons for leaders and non-leaders	65

List of Tables

2.1	Leadership Theories in Agile Teams	21
3.1	Team A information	26
3.2	Team B information	28
4.1	Style, FRLM Factors and MLQ account	50
4.2	Style Comparisons	53
4.3	Sample Demographic Data	56
4.4	Team Information	57
4.5	Correlations and significance between leadership styles and attribution factors for leaders	60
4.6	Correlations and significance between leadership styles and attribution factors for non-leaders.	61
4.7	Descriptive statistics for factors associated with vignettes (Leaders).	63
4.8	Descriptive statistics for factors associated with vignettes (Non-leaders).	63
4.9	Mann-Whitney tests: Comparing leaders and non-leaders across vignettes and leadership assignment factors.	66
6.1	Comparison between Gren and Ralph (2022) and this Thesis	86
6.2	Comparison between Amit et al. (2009) and this Thesis	88
6.3	Comparison between Coelho et al. (2024) and this Thesis	89
6.4	Comparison between Dunaetz et al. (2024) and this Thesis	91

List of Symbols

SE	Software Engineering
RQ	Research Questions
TFL	Transformational Leadership Theory
TSL	Transactional Leadership
PAVL	Passive/Avoidant Leadership
XP	Extremme Programming
PO	Product Owner
SLT	Situational Leadership Theory
DTLT	Dynamic Team Leadership Theory
MLQ	Multifactor Leadership Questionnaire
FRLM	Full Range Leadership Model
TDD	Test Driven Development

Contents

1	Introduction	1
1.1	Context	1
1.2	Problem	2
1.3	Goals	3
1.4	Justification	5
1.5	Research Design	6
1.5.1	Philosophical approaches	6
1.5.2	The Design	10
1.6	Structure of this Thesis	11
2	Agile Leadership	13
2.1	Leadership in Agile Software Development	13
2.2	Theories Supporting Agile Leadership	15
2.2.1	Dynamic Team Leadership Theory	15
2.2.2	Servant Leadership Theory	16
2.2.3	Transformational Leadership Theory - TFL	17
2.2.4	Situational Leadership Theory	19
3	Views on Agile Leadership for Software Teams: A Case Study with Leaders and Non-Leaders	22
3.1	Purpose	22
3.2	Methodology	24
3.2.1	Case study design	24
3.2.2	Data Collection and Analysis	29

3.3	Results	32
3.3.1	Non-leaders' Perspective on Leadership and How it is Shared	33
3.3.2	Leaders' Perspective on Leadership and How it is Shared	37
3.3.3	Summarizing the answer to the research questions	40
3.4	Discussion of the results	40
3.4.1	Situational Leadership Theory and Dynamic Team Leadership Theory	41
3.4.2	Non-Leaders' perspective	41
3.4.3	Differences between Leaders and Non-Leaders' Leadership View	42
3.5	Implications	43
3.6	Threats to Validity	44
3.6.1	Construct Validity	44
3.6.2	Internal Validity	45
3.6.3	External Validity	45
3.7	Conclusion of the Chapter	45
4	A Survey on Leadership Styles in Agile Software Teams	46
4.1	Purpose	46
4.2	Methodology	48
4.2.1	Participants	48
4.2.2	Study Instrument	49
4.2.3	Procedure and Measurement	52
4.3	Results	54
4.3.1	Sample Demographic Data	55
4.3.2	Overview About Leadership Styles - Leaders and Non-leaders	58
4.3.3	RQ3 - Correlations between leadership assignment factors and perceived leadership styles by leaders and non-leaders	60
4.3.4	RQ4 - Differences between leaders and non-leaders perceptions about leadership activities assignment factors in different activities (vignettes)	62
4.3.5	Summarizing the answer to the RQs	69
4.4	Discussion of the results	70

4.4.1	Overview of Leadership Styles in Agile Teams	70
4.4.2	Correlations between Leadership Styles and Attribution Factors in Agile Teams (RQ3)	72
4.4.3	Differences between Leaders and Non-Leaders (RQ4)	73
4.4.4	Implications	75
4.5	Threats to Validity	76
4.5.1	Construct Validity	76
4.5.2	Internal Validity	76
4.5.3	External Validity	77
5	General Discussion	78
5.1	Convergence and Divergence in Leadership Perceptions	78
5.1.1	Leadership Assignment Factors	79
5.2	The Role of Leadership Styles in Agile SE Contexts	80
5.3	General Implications and Contributions	81
5.3.1	Practical Implications for Agile Software Development Teams	83
5.3.2	Practical Implications for Managers of Agile Software Development Teams	84
6	Related Work	85
6.1	“What Makes Effective Leadership in Agile Software Development Teams?” by Lucas Gren and Paul Ralph - 2022.	85
6.2	“Leadership-shaping Experiences: a Comparative Study of Leaders and Non-leaders” by Amit et al. - 2009.	87
6.3	“A Comparative Study between the Views of Leaders and Followers on the Importance of Soft Skills in Software Development” Coelho et al. - 2024 - in Portuguese	87
6.4	“Self-leadership practices and beliefs in nonprofit organizations: differences between leaders and non-leaders” by Dunaetz et al. - 2024	89
7	Conclusions and Future Work	92
7.1	Ideas for Future Work	93

7.2	Final Considerations	94
A	Appendix: Publications	102
B	Supplementary material (Case Study)	103
B.1	Interview Guide - Phase I	103
B.2	Observation Script	105
B.3	Inicial Statements (in portuguese)	107
B.4	Concept Maps	111
B.5	Second Interview: Survey for leaders - Phase II	113
B.6	Nomination and refinement of Themes	114
B.7	Examples of Observation Mind Maps	119
C	Supplementary material (Survey)	121
C.1	Questionnaire - in portuguese	121
C.2	R Code - Statistics analysis	128
D	Annexes	129
D.1	Informed Consent Form (Qualitative and Quantitative Studies)- in portuguese	129
D.2	Consent of the Ethics Committee - in portuguese	136

Chapter 1

Introduction

1.1 Context

Project leadership plays a crucial role in guiding, inspiring, and aligning individuals and teams toward shared goals. It is considered one of the key drivers of success for projects and organizations (BASS; RIGGIO, 2006). In Software Engineering (SE), with the advent of the Agile Manifesto in the early 2000's (BECK et al., 2001) and the increasing complexity and dynamism of the software development landscape, there is a growing need for more adaptable and flexible leadership approaches. However, leadership in this context is not limited to the application of agile project management methods but represents a more comprehensive approach that permeates between different organizational cultures and different structures of software teams (MACGREGOR; HSIEH; KRUCHTEN, 2005), (GREN; LINDMAN, 2020).

Regardless of the culture and context where these teams are inserted, what is expected is that this form of leadership values adaptability, team autonomy, and decentralized decision-making rather than a rigid hierarchy, favoring the distribution of responsibility and promoting self-regulation. In addition, agile leaders seek to create an environment where team members feel valued, encouraged to contribute their ideas, and motivated to achieve shared goals. This not only improves employee satisfaction and well-being, but also directly impacts the quality and efficiency of software development (WEICHBRODT et al., 2022).

In short, agile leadership emerges as a response to address the increasingly complex demands of software development. By adopting an agile leadership approach, teams are supposed to become more resilient and effective in the search for innovative and high-quality

solutions. For this reason, the role of the leader in the team is still of fundamental importance (MODI; STRODE, 2020).

1.2 Problem

There are numerous kinds of research on leadership in the literature, permeating areas such as psychology (e.g. (HOGG, 2001)), administration (e.g. (RAY, 2023)), education (e.g. (YALÇIN; ÖZGENEL, 2021)), health (e.g. (SAMPSON, 2023)) and other areas (e.g. military (BARFOD; CLIFTON, 2025)). However, a systematic review on leadership in SE concludes that more empirical studies are needed to better understand agile leadership in this context (MODI; STRODE, 2020). Several questions arise: How is it actually employed? Which styles are more efficient for the software development process? Among other questions. Thus, in the literature, we observe that there are already some works that study this agile leadership, whether involving organizational cultures (SIKAS; SIKAS, 2007), (STRODE; HUFF; TRETIAKOV, 2009), (KÄNSÄLÄ; TOKUMARU, 2023); most effective leadership styles (MODI; STRODE, 2020), (ARAÚJO et al., 2022); group dynamics (GREN; LINDMAN, 2020), (KOZLOWSKI et al., 2008), among others. Those papers often focus on team leaders and their practices, but there remains no consensus on what constitutes effective agile leadership in this domain.

Gren and Ralph (2022) explored SE leaders' perspectives on effective agile leadership and found that it (i) is not restricted to a single individual but dynamically shared among team members; (ii) promotes agility, a strong sense of belonging, and collaboration within the team; and (iii) balances the integration of diverse organizational cultures (GREN; RALPH, 2022). However, most research on leadership in SE tends to focus exclusively on leaders (GREN; RALPH, 2022; MOE; DINGSØYR; DYBÅ, 2009; ARAÚJO et al., 2022; ELLAHI et al., 2022; YANG; HUFF; STRODE, 2009; LI et al., 2006), neglecting the perspectives of non-leaders who play critical roles in self-organized or self-managed teams where leadership is distributed (GREN; RALPH, 2022). While some studies have addressed aspects of agile leadership, there is limited understanding of how non-leaders perceive leadership in these teams (MODI; STRODE, 2020).

These inquiries fostered our Research Questions (RQ), which are:

RQ1: Are there differences in how leadership is shared by leaders between non-leader team members?

RQ2: Are there differences in the leadership view between leaders and non-leaders?

RQ3: What is the relationship between factors for assigning of leadership activities and leadership style perceived by leaders and non-leaders?

RQ4: Are there differences between leaders' and non-leaders perceptions of factors for assigning certain leadership activities?

RQ1 focuses on the practice of shared leadership, exploring whether leaders distribute leadership activities differently among members who are not formal leaders. Such leadership activities include, for example, delegating tasks, participating in strategic decisions, and leading meetings, among others. RQ2 emphasizes the perception of leadership as being relevant because it can reveal gaps between how leaders see themselves and how team members perceive them.

RQ3 addresses the relationship between factors used to assign leadership activities, identified in the previous study, and perceived styles (transformational, transactional, passive/absent). This RQ seeks to assess whether factors such as experience, time in the team, team size, or aptitude influence how the leadership style is identified. RQ4 complements RQ3 and deepens RQ1, focusing on the perception of the factors used to assign leadership activities and seeking to identify whether there is consensus or conflict regarding the factors to be assigned. Overall, this set of RQs seeks to cover both the practice and the perception of leadership in teams, seeking to understand how leaders and non-leaders interpret and experience the leadership process in software development.

1.3 Goals

The main goal of this thesis is to evaluate how agile leadership is perceived by leaders and, mainly, by non-leaders in software development teams, seeking to understand how leadership responsibilities are shared with members who do not identify themselves as leaders and propose recommendations that contribute to improving leadership processes and practices in agile contexts. To achieve this goal, specific objectives were defined that cover different dimensions of leadership: (i) to assess differences in the way leaders share leadership with

team members who do not hold formal leadership positions; (ii) to identify divergences in the vision of leadership between leaders and non-leaders; (iii) to identify and analyze the factors that influence the assignment of leadership activities in agile teams.

The study also seeks to (iv) investigate how these factors — such as technical experience, time in the team, aptitude, and availability — relate to the leadership styles perceived by leaders and non-leaders (transformational, transactional, and passive/absent); (v) determine whether these styles present significant correlations with the factors used in leadership delegation; and (vi) compare the perceptions of leaders and non-leaders on the criteria that guide the assignment of leadership activities. Furthermore, the study aims to (vii) assess whether leaders and non-leaders attribute different weights to factors such as technical experience, team time, aptitude, or availability when delegating responsibilities, (viii) identify significant differences in these perceptions that may impact leadership dynamics and collaboration in agile teams, and, finally, (ix) propose practical recommendations to improve the agile development processes adopted by these teams.

To this end, the methodology adopted consisted of two complementary studies, integrating qualitative and quantitative approaches to analyze agile leadership in software development teams comprehensively. The first study, of a qualitative nature, was conducted through a case study in agile teams, using semi-structured interviews and direct observations to explore how leaders share responsibilities and how leaders and non-leaders perceive leadership. The second study, of a quantitative nature, consisted of a survey applied to a broader audience, allowing the collection of data on factors that influence the assignment of leadership activities and the relationship of these factors with perceived leadership styles.

The results showed significant differences in how leadership is shared and perceived by leaders and non-leaders in agile teams. Leaders value technical expertise and time on the team more, while non-leaders emphasize aptitude and availability in assigning responsibilities. In addition, leaders tend to see themselves as transformational, but non-leaders often perceive transactional or passive practices. Factors such as team time and aptitude showed correlations with perceived leadership styles.

The studies answered the RQs by identifying apparent differences in how leadership is shared (RQ1) and in the perceptions of leadership between leaders and non-leaders (RQ2). The results also showed that factors such as experience, tenure in the team, aptitude, and

availability influence the assignment of leadership activities and are related to perceived leadership styles (RQ3). In addition, divergences were found in the perceptions of leaders and non-leaders about the importance of these factors, revealing possible conflicts or misalignments in the delegation of responsibilities (RQ4). These findings allow us to understand leadership dynamics in agile teams better and suggest improvements for more effective practices.

1.4 Justification

The rationale for this work was based on the need to understand more deeply how the agile leadership process occurs in software development and how team members perceive this approach, especially those not in a leadership position. Since 2013, the author has been involved in some agile software development projects in which she took on leadership and project management roles. Through these experiences, she realized that, although the leader plays the role of guide and mentor, non-leaders also carry out leadership activities. However, she often noticed that, despite the agile mindset that encourages shared leadership, these professionals were unaware that they also participated directly or indirectly in the decision-making process and consequently contributed to the self-management of their teams. This led her to research this topic further, seeking to understand how these non-leader professionals perceive and comprehend the leadership they exercise.

In addition, agile leadership is highlighted as an effective model for dealing with the complexity and rapid changes inherent in the software industry (GREN; RALPH, 2022). However, the perception and interpretation of agile leadership can vary between leading and non-leading team members, significantly influencing the development process and the result of the software product or service (SPIEGLER et al., 2020). Thus, by investigating how these groups of individuals perceive agile leadership, we can identify points of convergence and divergence in their perspectives. They hypothesize that these different perceptions can affect collaboration, communication, decision making, and team motivation and impact the execution of typical agile software development activities, such as agile ceremonies, activity estimations, and planning.

Therefore, we justify this thesis by the need to fill a knowledge gap in understanding

the perceptions of agile leadership among leaders and non-leaders of software development teams and by the potential to contribute to improving software processes and products through recommendations for these teams.

1.5 Research Design

For study design, we begin by examining the philosophical approaches that influenced the development of the two studies (Chapters 3 and 4), qualitative and quantitative research, respectively. For both studies, we present the methodology design, providing an overview of the processes carried out in each study. Details such as participants, instruments and data analysis of each study are detailed in their respective chapters.

1.5.1 Philosophical approaches

Different philosophical paradigms, such as the constructivist and positivist paradigms, can be adopted to understand the same research phenomenon. In this sense, the perspectives of a research project are influenced by the paradigm chosen, which is closely linked to the profile and interests of the researcher (BATISTA, 2021).

In this thesis, the studies are based on the constructivist (or interpretivist) paradigm and the positivist paradigm, which Batista (2019) considers a multi-method approach. Researchers aligned with the constructivist paradigm, for example, believe that each situation is unique and that a given context cannot be generalized to another, in addition to seeking to build theories that depend more on the context than on testing them, as occurs in positivism. On the other hand, researchers aligned with the positivist paradigm believe that reality can be understood through relationships between quantitative variables and statistical methods that make it possible to predict and establish causal relationships (BATISTA, 2021; DEMO, 2009 - in portuguese). These paradigms are theoretical and methodological structures that interpret the phenomena researchers adopt (BATISTA, 2021).

Approaches for the Qualitative Study

For the first study, presented in Chapter 3, based on a qualitative nature by adopting the constructivist paradigm, we are basing ourselves on social reality, which leads to interpre-

tivism (BALTES; RALPH, 2022). Interpretivism argues that reality is based on the culture and social paradigm of a group or society, in which the resources of the natural sciences are insufficient to understand the human meaning and the nature of the social world and may not be fully understood because they are subjective (BATISTA, 2021). For Baltes and Ralph (2022), interpretivists believe that each situation is unique and that a given context cannot be generalized to another, in addition to seeking to build theories that depend more on context than on tests, as is the case with positivism. Thus, the interpretivist paradigm favors case study research that studies human phenomena in diverse contexts and environments.

It leads the researcher to make observations and interact with the population studied, directly or indirectly, in order to capture their point of view (BATISTA, 2021). In our case, the interpretivist paradigm qualifies the point of view of software developers (who do not consider themselves leaders) about the leadership they observe and experience. It can sometimes be exercised in their teams, where case study methodology is suitable for software engineering research because it studies “contemporary phenomena in their natural context,” helping to provide a deeper understanding of these phenomena (RUNESON; HÖST, 2009).

The ABC Framework for Research Strategy - Qualitative Study As a research strategy, we settled on the ABC framework proposed by Stol and Fitzgerald (2020), which is nothing more than a guide of research strategies as a model to structure research in search of knowledge in software engineering. The ABC represents three desirable aspects of research: generalizability about **actors (A)**, precise control of **behavior (B)**, and realism of **context (C)**, aspects that cannot be simultaneously maximized (STOL; FITZGERALD, 2020).

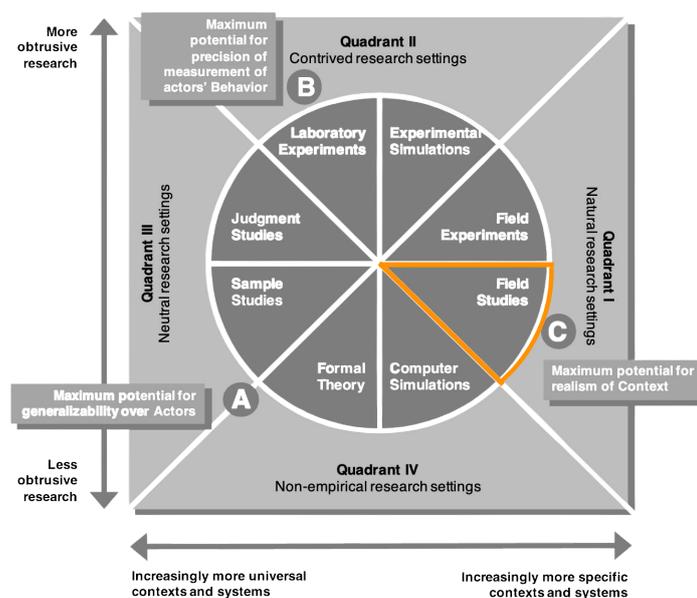
In the context of this research, actors (A) are software developers that include programmers, leaders, analysts, and other roles within a software development team; the behavior (B) relates to these software developers with their leadership-related skills; and the context (C) refers to the teams in which these developers are embedded.

Two dimensions support the ABC framework on these three aspects: obtrusiveness and generalizability. The first is related to the degree of the researcher’s intrusiveness in the research environment, and the second is the generalizability of the results. Since this is an exploratory study, generalizability is not the goal of this type of study because it aims to develop an understanding of the results used to theorize and propose hypotheses about other

similar contexts (STOL; FITZGERALD, 2020). Thus, we minimize the generalizability of the evidence among populations of actors (A), with little control over the behavior of these actors (B), which consequently increases the realism of the context (C).

And on these dimensions, the authors outlined eight research strategies: field study, field experiment, experimental simulation, laboratory experiment, judgment study, sample study, formal theory, and computer simulation (STOL; FITZGERALD, 2020). As shown in Figure 1.1, this study falls into quadrant C, field study, as it fits better into the case study context, since we are identifying phenomena about leadership from the point of view of non-leaders in their natural environment to understand what is happening or how they view effective leadership from their perspective. This, according to the ABC framework, presents a maximum potential for context realism, with less intrusive research and increasingly more specific contexts and systems.

Figure 1.1: ABC Framework - Qualitative Study - Stol and Fitzgerald (2020).



Approaches for the Quantitative Study

As a quantitative study, the second study, presented in Chapter 4 falls within the positivist paradigm since it uses quantitative methods to test hypotheses and identify causal relationships between variables (BALTES; RALPH, 2022).

In the positivist paradigm, sampling is probabilistic, which is fundamental for quantitative research since it aims to ensure that the sample is representative of the population,

allowing the results to be generalized (BALTES; RALPH, 2022). Based on the belief in an objective and measurable reality, this approach seeks to identify causal relationships between variables and test hypotheses (BATISTA, 2021).

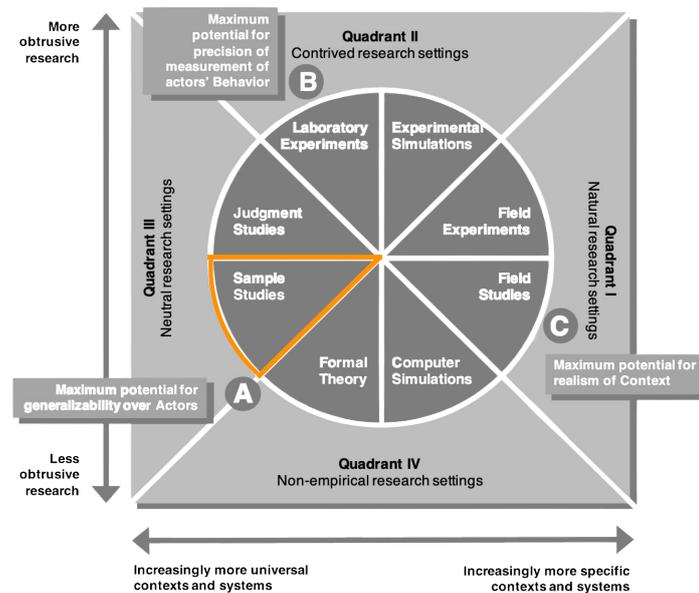
In this sense, representativeness is crucial for the validity of the results and the construction of general theories (BALTES; RALPH, 2022). However, the concern with representativeness varies according to the study's objective. External validity may be less relevant in research that is not aimed at generalization, such as laboratory experiments, as the focus is on testing hypotheses under controlled conditions (BALTES; RALPH, 2022). Thus, the choice of sampling method must consider the research paradigm adopted and the specific objective of the study (BATISTA, 2021).

After carrying out an initial qualitative study, it is common for new questions to arise, the need to test hypotheses, and the possibility of generalizing the findings to a wider population. In this context, the quantitative study becomes fundamental to increase the research's external validity by generalizing the results to a larger population, quantifying phenomena, and complementing methods, offering a more complete view of the phenomenon being studied.

The ABC Framework for Research Strategy - Quantitative Study In the same way as in the first study, the second study is a study using sampling, and generalization becomes one of the objectives of this type of study. Thus, our study can achieve a specific generalization (A) while sacrificing the realism of the context (C) and the precision of the behavior (B). Including the characterization of a data set and correlation studies (STOL; FITZGERALD, 2018).

In these dimensions, according to the eight research strategies of the ABC Framework, the quantitative study in this thesis falls into quadrant A (Figure 1.2), a sample study (quantitative), involving the collection of data from a sample population of leading and non-leading software developers, in order to understand and corroborate with the results of Chapter 3.

Figure 1.2: ABC Framework - Quantitative Study - Stol and Fitzgerald (2020).

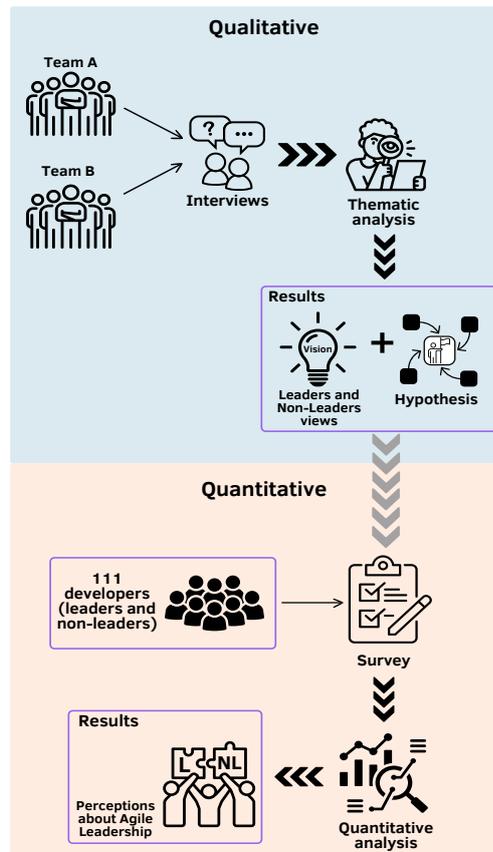


According to the ABC framework, this presents a neutral position characterized by being a less intrusive investigation than growing universal contexts and systems since “the research setting is neutral and is not a concrete or specific instance” (STOL; FITZGERALD, 2018).

1.5.2 The Design

As discussed in the previous sections, this thesis design is qualitative-quantitative, reflecting an integrative approach that combines qualitative and quantitative methods to address RQs in a comprehensive and multifaceted manner (BATISTA, 2021). This strategy aims to explore complex phenomena from multiple perspectives, allowing a deep understanding of individual experiences and the identification of broader patterns that can be generalized to larger populations. By adopting a quantitative-qualitative design, the thesis recognizes the strengths and limitations inherent in each approach, seeking to balance them in a complementary manner. The Figure 1.3 approaches this type of design in a sequential and exploratory manner, in which the qualitative phase precedes the quantitative phase.

Figure 1.3: Design of the Study.



This structure is beneficial when the phenomenon studied is not yet well understood or when there is a need to develop an initial understanding before formulating hypotheses for testing (BATISTA, 2021). Furthermore, the combined use of methods allows for triangulation, increasing the robustness and credibility of the results by integrating different data sources and analytical perspectives (BATISTA, 2021). Thus, this design offers a more complete and balanced view of the phenomenon under investigation, highlighting individual experiences and generalizable trends from the data.

1.6 Structure of this Thesis

Given the previous sections, this work is organized as follows: the next Chapter 2 - a background on Agile Leadership - deals with the state of the art of primary research on effective leadership in software development and the main corresponding theories. Chapters 3 and 4 present the two studies, a case study and a survey study, respectively, with their purposes,

methodologies, results, discussion, and individual implications. Then, Chapter 5 presents the general discussions of this thesis, followed by Chapter 6 with related work. Following that, Chapter 7 presents the conclusions, with general implications and ideas for future work. Finally, the appendices and annexes sections present all the relevant documentation for executing this thesis and a replication kit for both studies, respectively.

Chapter 2

Agile Leadership

Leadership is “the ability to influence others to achieve goals” (HUGHES; GINNETT; CURPHY, 1996). When we talk about leadership in its general concept, we come across several theories and situations of its application that vary according to different areas and, mainly, the context of the teams where it is used. Naturally, the term leader, at first, generated a feeling of hierarchy between them and their subordinates, which was common to see in the past (in Industry 1.0 and 2.0), where the production process aimed at higher profits and production expansion and the leaders imposed hierarchy on their subordinates. (SAKURAI; ZUCHI, 2018; PELINSKI et al., 2020).

With the advent of Industry 3.0 and 4.0, leadership is now concerned with developing their subordinates and moving from an autocratic and bureaucratic idea to a charismatic, transformational, and collaborative vision (PELINSKI et al., 2020). In this context, we have the production of software and technology, which today is based on the principles of agile processes (BECK et al., 2001), where leadership values the well-being and evolution of the people who make up the team, resulting in better performance and quality of its products and services (MODI; STRODE, 2020).

2.1 Leadership in Agile Software Development

Since the advent of the Agile Manifesto ¹, agile principles have been present in most software development teams (MODI; STRODE, 2020). Such principles focus on (i) individuals

¹<https://agilemanifesto.org/>

and interactions more than processes and tools; (ii) value working software more than comprehensive documentation; (iii) consider collaboration with the customer more than contract negotiation; and (iv) responding to change more than follow a plan (BECK et al., 2001).

To meet these values and principles, the leadership of these teams needs to adhere to lightweight processes that allow for changes throughout development. Therefore, practical guidelines for agile projects, such as the Scrum Guide Body of Knowledge (SBOK) (SCRUMSTUDY, 2016), the Lean Philosophy (HIGHSMITH, 2002), the Extreme Programming (XP) (BELL, 2001) or the Test Driven Development (TDD) (ASTEELS, 2003) lead the agile process in these projects. In any case, even with all available guidance, Modi and Strode (2020) reinforce that these and other sources of agile practices (Beck, 2000; Cockburn, 2002) provide little guidance on what constitutes effective agile leadership in teams of software development (MODI; STRODE, 2020).

In their systematic review of the literature, Modi and Strode (2020) found no consensus on which type of leadership is considered effective in this context, both from the research point of view and the industry practice. In practical terms, they observe a possible effective leadership based on the servant leadership theory, where personal and cultural characteristics are alongside the motivational dimension (DIERENDONCK, 2011), (MODI; STRODE, 2020). This leadership occurs when the leader empowers and develops people, expressing humility, authenticity, interpersonal acceptance, and guiding management. (DIERENDONCK, 2011).

Regarding empirical research, there are several perspectives on agile leadership (MODI; STRODE, 2020). One of them is self-management (or self-organization), where agile teams manage to organize themselves and control the process without the interference of a direct hierarchical leader, that is, without a centralized decision structure (MOE; DINGSØYR; DYBÅ, 2009). In this type of leadership, members of self-managed teams are responsible for managing and monitoring their processes and executing tasks so that leadership is shared and decision-making takes place together (MOE; DINGSØYR; DYBÅ, 2009).

Also, for Modi and Strode (2020), other studies indicate that agile leadership in software development teams should take the form of Transformational Leadership (TFL) (BASS; RIGGIO, 2006). For Bass and Riggio (2006), transformational leaders stimulate and inspire their followers to achieve extraordinary results and develop their own leadership capabilities

within the process in which they are inserted. Transformational leadership focuses on who keeps the development process active and evolving (ARAÚJO et al., 2022).

Recently, Gren and Ralph (2022) proposed what would be an agile and effective leadership in the view of leaders who command software development teams. For the leaders studied, effective leadership in the agile context needs to achieve three goals: (1) Be dynamically shared among team members; (2) Generate a sense of belonging to the team; and (3) Involve balancing competing organizational cultures, eg.: balancing and transitioning from a milestone-oriented to an agile culture (GREN; RALPH, 2022). To be dynamically distributed, leadership needs to let team members take the initiative and assume responsibility, interfere in the process when necessary, and let team members also take on leadership activities. The sense of belonging, in turn, needs to be strong among team members; that is, everyone needs to be on the same page and satisfied with what they do, building a solid social identity with the team. Finally, the balance between competing organizational cultures refers to understanding and adapting to the company's culture, adjusting old behaviors, and taking a personalized approach to any changes that may be necessary (GREN; RALPH, 2022).

2.2 Theories Supporting Agile Leadership

2.2.1 Dynamic Team Leadership Theory

For Gren and Ralph (2022), leadership is a type of work. In self-organizing and self-managing agile teams, even when there is no formal leadership position, it is common for someone to take on the role of leader. In fact, several team members may collaborate dynamically, sharing the responsibility for leading the team toward established goals (GREN; RALPH, 2022). Bolden (2011) explains that the concept of distributed or shared leadership was theorized in the 1920s and mentioned in a few articles until 1990. Only later on did conditions become conducive to accepting distributed leadership due to changes in teams, which became cross-functional, requiring faster delivery and dissemination of information, increasing the complexity of work (BOLDEN, 2011). In this period, transformational and servant leadership approaches were predominant, as explained below. Ten years ago, distributed and shared perspectives on leadership gained more attention (BOLDEN, 2011), which can

be attributed to the fact that agile methods were widely spread, especially in the software industry. However, research on leadership in software engineering is still scarce, needing more attention, and more empirical studies are needed to understand agile leadership better (GREN; RALPH, 2022), (MODI; STRODE, 2020), (WEICHBRODT et al., 2022).

2.2.2 Servant Leadership Theory

Servant leadership demonstrates empowerment and growth of individuals, the display of humility, authenticity, interpersonal acceptance, stewardship, and the provision of guidance (DIERENDONCK, 2011). This theory argues that the leader should serve the followers by putting their needs first, seeking to develop their potential, and contributing to their personal and professional growth (PARRIS; PEACHEY, 2013). Also inspires shared leadership in agile teams, as it encourages team members to help each other, offering feedback, guidance, and support without hierarchy or authoritarianism.

There are other leadership theories that resemble servant leadership (DIERENDONCK, 2011), such as TFL (BASS; RIGGIO, 2006), authentic leadership (GARDNER et al., 2011), ethical leadership (MENDONCA; KANUNGO, 2006), spiritual leadership (FRY, 2003), selfless leadership (BROOKES, 2017), among others. Even though they have differences, both share a common goal of developing the individuals within the team.

Holtzhausen and Klerk (2018) checked, in a cross-sectional study, to what extent Scrum Masters use servant leadership and how this affects team effectiveness. For the authors, the Scrum Master is sometimes seen as a servant leader for the Scrum team, having a moderately strong correlation between the Scrum Master's servant leadership and team effectiveness, where the results confirm the importance of servant leadership skills in developing agile leadership, appointing the leader role, and implementing Scrum practices effectively (HOLTZHAUSEN; KLERK, 2018).

Software projects have many requirements related to processes and products, which include several essential characteristics. Among them are maintainability, robustness, correctness, productivity, timeliness, visibility, reliability, efficiency, and usability (ELLAHI et al., 2022). Ellahi et al. (2022) conducted a study investigating servant leadership's crucial role in project success, particularly in Pakistan's software industry. The results revealed that servant leadership plays an essential role in the effectiveness and motivation of the project team, pro-

viding better results to achieve successful goals. By motivating team members and increasing their skills and productivity, it becomes possible to cope with software projects' complex and intense demands. The researchers concluded that software teams should prioritize project and team goals and objectives, paying attention to the effects of servant leadership because it influences team motivation and effectiveness (ELLAHI et al., 2022).

2.2.3 Transformational Leadership Theory - TFL

Burns (1978) developed the TFL theory, which focuses primarily on meeting basic needs and fulfilling higher desires, inspiring followers to provide innovative solutions and create a better work environment (GHASABEH; SOOSAY; REAICHE, 2015).

When talking about TFL, four dimensions identify the characteristics of a transformational leader, known as the 4 "T"s (BASS; RIGGIO, 2006), (ARAÚJO et al., 2022):

- a) Idealized influence: when the leader acts as a role model, and his followers respect, admire, and trust him, developing a shared vision and improving relationships among team members;
- b) Individualized consideration: when the leader gives special attention to his followers individually, enabling them to create a learning climate;
- c) Intellectual stimulation: when the leader makes his followers analyze the problems in new ways, from different angles, encouraging the sharing of knowledge within the company to generate more innovative ideas and solutions;
- d) Inspirational motivation: when the leader motivates his followers by setting meaningful goals for them and inspiring them to achieve them.

When discussing TFL, most articles identify and compare the Transactional Leadership (TSL) and the laissez-faire leadership style, which, together with the TFL style, generate the Full-range Leadership Model (FRLM) (YANG; HUFF; STRODE, 2009), (ARAÚJO et al., 2022), (MAROUKIAN; GULLIVER, 2020), (WEICHBRODT et al., 2022), (AVOLIO; BASS; JUNG, 1999), (LI et al., 2006). A TSL or a laissez-faire leader presents these dimensions (characteristics) (ARAÚJO et al., 2022):

- a) Contingent reward: when the leader recognizes what needs to be done, support in exchange for the necessary effort;
- b) Management by exception (active and passive): when the leader gets organized to know if something went wrong, remaining alert for breaches of the rules (active); or when the leader takes no action unless some problem arises (passive);
- c) Laissez-faire: When the leader (laissez-faire) withdraws from her/his role and offers little in terms of direction or support.

The FRLM is a multidimensional model that assesses the intensity of these three leadership styles (TFL, TSL, and Laissez-faire) based on the dimensions (behaviors or characteristics mentioned above) of each and the frequency with which leaders demonstrate these behaviors. In this context, any leader may present a more significant predominance in the factors associated with the TFL, TSL, or Laissez-faire styles, depending on their attitudes toward the team (ARAÚJO et al., 2022).

In practical software engineering terms, TFL is intertwined with the practices and characteristics of agile leaders since they provide continuous guidance and support to their subordinates, creating a collaborative environment and allowing them to make decisions, characteristic of self-managing teams (RIAZ; MAHBOOB; BURIRO, 2018). The leader, in this case, acts as a facilitator and is not seen as a central figure who makes all the decisions (GREN; RALPH, 2022), (MODI; STRODE, 2020).

Some studies in the software area have verified transformational leadership related to agility, project success, and workforce retention in the area: Weichbrodt et al. (2022) investigated the relationship between transactional and transformational leadership and agility in IT organizations. The authors found that agility is associated with the transformational style, but they also recognize the importance of the transactional style, especially as shared leadership (WEICHBRODT et al., 2022).

Yang, Huff, and Strode (2009) examine the impact of agile methods on information systems development and project management with the full-range leadership model to analyze project managers' perceptions of leadership styles appropriate for agile and traditional projects. The results indicate that project managers perceive the need for more TFL to succeed in agile projects compared to traditional projects (YANG; HUFF; STRODE, 2009).

Li et al. (2006), in their study of leadership in open-source software projects, state that project success depends on the organization and motivation of developers by their leaders. They investigated the behavioral effects of leaders on developer motivation and proposed a research model tested with 118 open-source software developers. The results showed that leaders' TFL is positively related to developers' intrinsic motivation, while management by exception (active form), from transactional leadership, is positively related to developers' extrinsic motivation (LI et al., 2006).

Ghafourian et al. (2010) investigated the relationship between leadership styles (TFL and TSL) and turnover intention among developers in Iran. The results indicated that TFL has importance in reducing turnover intention (SHARIFHERAVI; SHAHIDI; MAHMOOD, 2010).

Also part of this thesis is the paper we published in 2022 in the XXXVI Proceedings of the Brazilian Symposium on Software Engineering (SBES) (ARAÚJO et al., 2022). We had inspired by Ghafourian et al. (2010) and verified the TFL, TSL and Laissez-faire leadership styles with turnover intention among Brazilian developers. The results showed that TFL and TSL styles are positively correlated with each other, indicating that these styles can develop together, promoting motivation, guidance, and contributing leaders for self-managed teams, with evidence that the laissez-faire (passive/avoidant) style promotes a less active role for leaders that can lead to the empowerment of followers and motivate them to make decisions and take responsibility, characteristics necessary for self-managing agile teams (ARAÚJO et al., 2022).

2.2.4 Situational Leadership Theory

Situational leadership theory was developed by Paul Hersey and Ken Blanchard in the 1970s. This theory proposes that there is no single ideal leadership style that works in all situations but that the most effective leadership style varies according to the level of readiness or maturity of those being led to the specific task they need to accomplish (SCHERMERHORN, 1997). In other words, it varies according to people, tasks, times, and needs (GRAEFF, 1997).

Situational leadership theory is based on two main concepts: leadership behavior and non-leaders readiness. On leadership behavior, Hersey, Blanchard, and Natemeyer (1979)

identified four main styles, each associated with different levels of direction and support provided by the leader (HERSEY; BLANCHARD; NATEMEYER, 1979):

- a) Telling: In this style, the leader provides clear and specific instructions on what needs to be done without giving much scope for the leader to make decisions;
- b) Selling: Here, the leader continues to provide direction but also seeks the involvement of the leader and explains the decisions made;
- c) Participating: The leader offers emotional support and listens to the ideas and suggestions of the team members, allowing them to participate in decision-making actively;
- d) Delegating: In this style, the leader passes responsibility almost entirely to the team member, allowing them to make decisions and act more independently.

Regarding the non-leaders readiness, it refers to their ability and willingness to perform a specific task. It is assessed based on two main situational factors:

- a) Competence: The level of skill, knowledge, and experience of the leader in the task at hand;
- b) Commitment: The leader's motivation and confidence to perform the task successfully.

According to the situational leadership theory, the combination of leadership behavior and the level of readiness of the leader determines the most appropriate leadership style for a given situation (HERSEY; BLANCHARD; NATEMEYER, 1979). For example, if a leader is highly competent and motivated to accomplish a specific task, the leader may adopt a more delegation-oriented style. On the other hand, if a team member is inexperienced and insecure, the leader may need to be more directive and provide clear instructions (GRAEFF, 1997).

Importantly, situational leadership requires leaders to be flexible and adapt their leadership style according to the needs and characteristics of the team members and the task at hand. In addition, leaders must be willing to invest time and effort in developing the skills and competencies of those they lead, seeking to increase their readiness over time (GRAEFF, 1997), (SCHERMERHORN, 1997).

Once leadership has adaptable characteristics, it is easily integrated into agile teams and their different contexts and situations, which may vary during the development process. Thus, some works in software engineering study this type of leadership: Varanasi (2018) conducted a case study to explore the perspective of leadership requirements in Scrum-based software development. As a result, the units of analysis (indian development teams) implement situational leadership and transformational leadership in a mixed way. In general, the teams implement directive leadership with the coexistence of collaborative leadership in a situational way (VARANASI, 2018).

Bosse et al. (2017) present the design of an agent-based leadership support system that exploits a computational model for the development of individuals or groups. Such a system builds on situational leadership theory and model-based reasoning techniques, monitoring and analyzing the level of development over time. As a result, the simulations highlighted the model's ability to estimate a group's development level and derive appropriate behaviors for the leader of that group. (BOSSE et al., 2017).

The following Table 2.1 summarizes the theories explained above.

Table 2.1: Leadership Theories in Agile Teams

Theory	Description	Main characteristics	Applications in Agile Teams
Dynamic Team Leadership Theory	Leadership is seen as a type of work. In self-managed agile teams, multiple members can share leadership without a formal leader.	- Distributed leadership - Dynamic collaboration - Shared responsibility	- Reinforces the idea of shared leadership and rapid adaptation. - Essential in self-managed and agile teams.
Servant Leadership Theory	Leadership must serve followers, prioritizing their needs and promoting personal and professional growth.	- Empowerment - Humility - Development of team members' skills	- Promotes a supportive and collaborative environment in agile teams. - Encourages feedback and mutual assistance without hierarchy.
Transformational Leadership Theory	Focuses on inspiring followers to provide innovative solutions and create a better work environment, meeting basic and superior needs.	- Idealized influence - Individualized consideration - Intellectual stimulation - Inspirational motivation	- Facilitates a collaborative environment in agile teams. - Encourages innovation and autonomy, which are important characteristics in self-managed teams.
Situational Leadership Theory	Argues that there is no single ideal leadership style, the most effective being the one that adapts to the level of readiness of followers to carry out a task.	- Flexible leadership behavior - Competence and commitment assessment - Styles: Telling, Selling, Participating, Delegating	- Leadership adaptable to the context of the agile team. - Allows the leader to adjust his/her behavior according to the situation and the team's development.

Chapter 3

Views on Agile Leadership for Software Teams: A Case Study with Leaders and Non-Leaders

This study was published in the research track at the 38th Brazilian Symposium on Software Engineering (2024), available at the Library of the Brazilian Computer Society.¹ This study contributes to understanding leadership dynamics in agile software development teams by comparing the perspectives of leaders and non-leaders. By identifying similarities and differences in leadership views, this paper provides insights that can influence SE team management strategies and leadership development practices.

3.1 Purpose

The **primary purpose** of this first study is to assess how agile leadership, with its principles of sharing responsibilities and collaborative decision-making, is seen mainly by those who do not consider themselves leaders, and whether there are significant differences and similarities in the way leaders share this leadership among team members who are not leaders.

This prompted the following research questions:

RQ1: Are there differences in how leadership is shared by leaders between non-leader team members?

¹Paper: *Views on Agile Leadership* (SBES 24).

RQ2: Are there differences in the leadership view between leaders and non-leaders?

The first question aims to understand whether and how leaders share leadership differently with different team members who are not leaders. It is relevant for assessing the effectiveness of self-management practices in the software development process. The second question, therefore, aims to identify whether leaders and non-leaders have different perspectives on the leadership view, i.e., how it is practiced. Understanding these differences can inform leadership development programs, improve team communication, and align expectations to increase cohesion and productivity.

For us, *non-leaders* are those individuals or members of software development teams who do not play self-appointed leadership roles in that context, i.e., they do not play a leadership role but eventually take on leadership activities, such as decision-making (whether at an operational or strategic level), leading meetings, mentoring less experienced colleagues, among others (SOMMERVILLE, 2011 - in portuguese). In other words, they do not occupy designated positions of leadership or authority, and their influence on decision-making and group guidance can be limited. This raises the question of how agile teams actually function in terms of leadership and whether expectations regarding agile leadership are aligned with the reality of the daily practices of software development teams.

Since different interpretations of agile leadership can influence team dynamics, communication, decision-making, and motivation, ultimately affecting the software development process and product quality (SPIEGLER et al., 2020), this qualitative study aims to contribute insights into the role of agile leadership in software development, which can, in turn, help improve software processes and outcomes.

We also verified the team leaders' vision, aiming to compare our case study with Gren and Ralph's (2022) work. The RQs of the first study have no intention to understand the balance of competing organizational cultures, as identified by Gren and Ralph (2022), since the studied teams are already inserted in the agile culture since their formation.

3.2 Methodology

3.2.1 Case study design

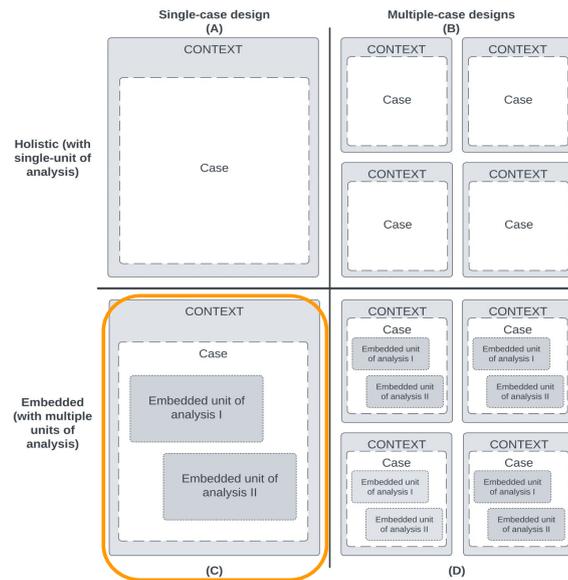
We used the case study guide in software engineering proposed by Runeson and Höst (2009), which offers some steps that the researcher can follow to carry out a case study in an integral way that meets the requirements within the context of software engineering. Thus, the objective of the case study, carried out for this research, of a qualitative nature, is not the generalization for statistically significant samples of the studied population but the conduction of an exploratory path, as the interpretivist paradigm preaches. This type of case study aims to develop an understanding of the studied phenomenon and can be used to theorize and propose hypotheses about other similar contexts (STOL; FITZGERALD, 2020).

Units of Analysis and Participants

The units of analysis specify what or who is studied within the case. In software engineering, the case can be a project, an individual or a team, a process, an event, a product, etc. (RUNESON; HÖST, 2009). Concerning this research, it is first necessary to specify the type of case study, which varies between holistic or integrated, and the design, whether single or multiple. Figure 3.1 presents the types and designs of possible case studies that can be used in software engineering research context. In holistic case studies, there is only a single unit of analysis, and the case is studied as a whole, which may have a single design (quadrant A) or multiple designs in different cases and contexts (quadrant B) (YIN, 2009). In integrated case studies, there is more than one unit of analysis verified within a single case (quadrant C) or in different contexts and cases with two or more units of analysis (quadrant D) (YIN, 2009).

In this study, the participants are software developers who work in two teams, each linked to two different companies and projects that differ in their domains. In this way, teams can be two units of analysis in an embedded case study (Figure 3.1 - C) since the context is to analyze how developers (non-leaders) perceive effective leadership from their point of view.

Figure 3.1: Case Study Design - Adapted from Yin (2009).



Context of Teams

Team A Team A is part of a project linked to a technology multinational in partnership with a university. This team is on the University side since those responsible for the team on the company side decided not to participate in the study. The relationship between the researcher and the team is related only to observation and research. There is no relationship between the researcher and the company. At no time did the researcher's entry into the team hinder the work of the participants. Table 3.1 displays the main characteristics of the team A participants.

Team A comprises five men and two women developers, and one considers himself a leader who has been within the project for more than two years and has experience with leadership in previous teams. The other team members do not consider themselves leaders and have been with the project for one or one and a half years. Among these developers, three are still undergraduates. Both work in a hybrid/remote way, i.e., the team members are only sometimes physically present at the workplace (University lab) and hold their meetings and other activities always remotely via chats and video conferences. The team uses an agile process based on Scrum and Extreme Programming (XP).

The project aims to create research, development, and innovative solutions related to evolving an ecosystem of application observation services for a multinational technology

Table 3.1: Team A information

ID/Team	Role in the team	Time in the team	Consider him/herself a leader	Education level
P1/A	Developer (programmer)	+ 1 year	No	Undergraduate
P2/A	Developer (programmer)	+ 1,5 year	No	Graduate
P3/A	Developer (programmer)	+ 1 year	No	Undergraduate
P4/A	Developer (programmer)	+ 1,5 year	No	Graduate
P5/A	Developer (programmer)	+ 1 year	No	Graduate
P6/A	Developer (programmer)	+ 1 year	No	Undergraduate
P7/A	Leader/developer	+ 2 years	Yes	Graduate

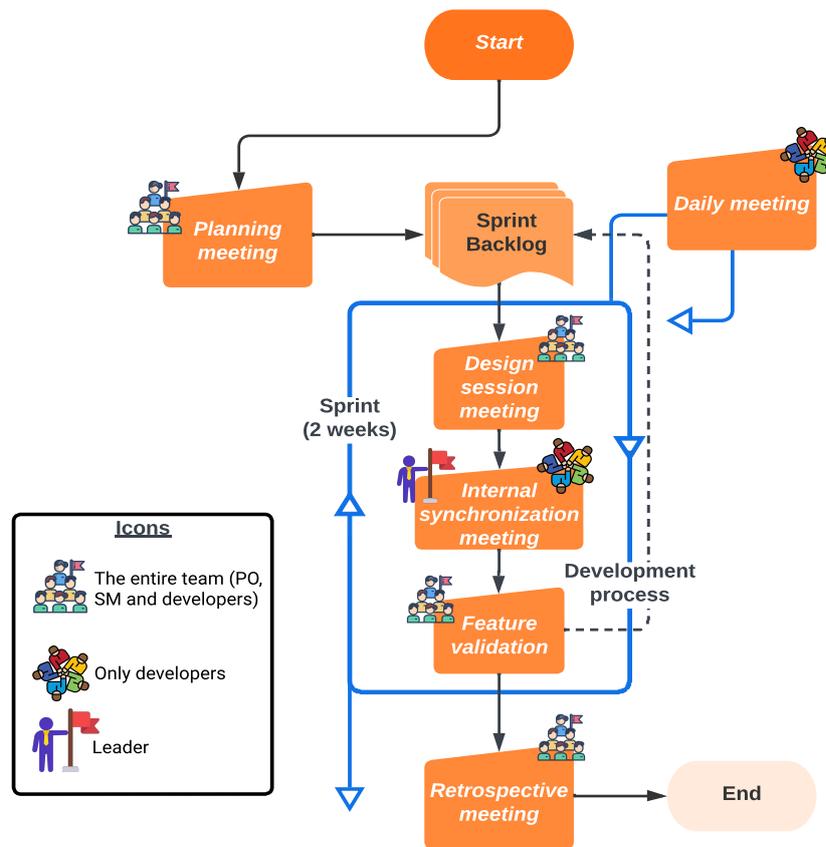
company. Within this context, this application supports the development of plugins for other tools and functionalities and the evolution of these systems, tools, and functionalities.

Figure 3.2 shows the agile process, based on Scrum and XP, executed by Team A. All meetings happen online and synchronously. The team uses the time to deliver parts of the product based on two-week sprints, starting with a planning meeting with the whole team, including POs, leaders, and developers from the company side team and researched team (university side). After this meeting, they define the sprint backlog, and the design session meeting, mediated by the PO, takes place. There, the activities are allocated and estimated by the whole team. Internally, the team holds internal synchronization meetings for alignment. The entire team holds daily meetings and, at the end of the sprint, when necessary, there is a validation of the developed features with discussions about specific situations. After the end of the sprint and before planning the next one, they hold retrospective meetings with everyone involved. Communication occurs via Mattermost chat² and the meetings via Microsoft Teams³. The development process usually occurs in pairs, a practice that XP encourages.

²<https://mattermost.com/>

³<https://tinyurl.com/naw7b675>

Figure 3.2: Team A agile process



Team B The second team (team B) belongs to a private digital solutions company located in Brazil. Their members work remotely and are spread across different states of the country. As with Team A, there is no relationship between the primary researcher and Team B's company except for research and observation, and the primary researcher has no input into the team. However, a second researcher participated in the data collection and analysis process to audit the process and reduce the bias of the main researcher. This researcher was part of team B as an intern in a learning position. Since he did not have access to specific chats and some meetings and was not directly involved in the development work, we consider that there were no significant impacts of bias in the interviews and observations. The same researcher also did not have access to team A's meetings, due to privacy issues of the company in question. However, he participated in the initial analysis process with both teams (see Figure 3.4). Table 3.2 displays the main characteristics of the team B participants.

Team B is composed of three male developers and one female, where one of them consid-

Table 3.2: Team B information

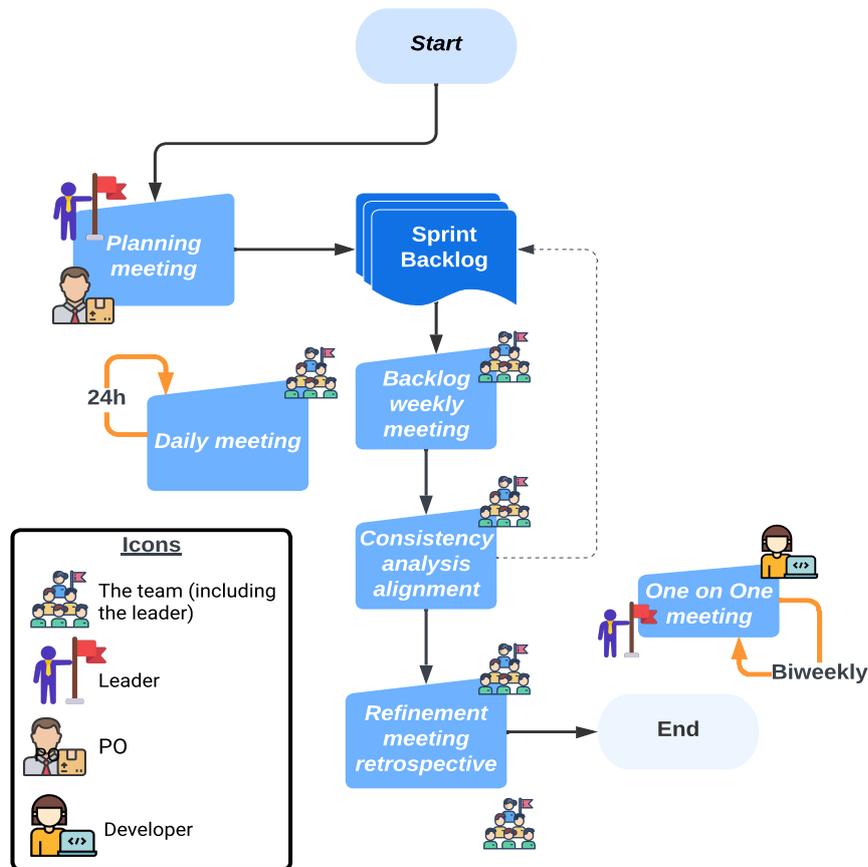
ID/Team	Role in the team	Time in the team	Consider him/herself a leader	Education level
P8/B	Developer (quality assurance analyst)	+ 2 years	No	Graduate
P9/B	Developer (programmer)	- 1 year	No	Graduate
P10/B	Developer (programmer)	+ 2 years	No	Graduate
P11/B	Leader (manager)	+ 3 years	Yes	Graduate

ers himself a leader and has been with the project for more than three years, having extensive experience as a leader in previous teams and software projects in general. The other team members do not consider themselves leaders. Two of them have been with the project for more than two years, and one has been with it for less than a year. All of them are college graduates. The whole team works remotely and conducts meetings and other activities via chat platforms and videoconferences. The team uses its own agile process model based on Scrum, Kanban, and XP.

The project aims to create innovative solutions to serve accounting firms and organizations in digital transformation or streamlining their operations in the context of tax compliance, offering controls, dashboards, secure document storage, process transparency, and management.

Unlike Team A, Team B does not use sprints as a structure for development deliveries and uses the Kanban flow to organize the process. As shown in Figure 3.3, the leader and the PO prioritize the resources that go into the backlog in planning meetings. In the weekly backlog meetings, the leader conveys to the development team the decisions for the iteration, and together they estimate a time for each activity. After developing the backlog items for the iteration, testing, and homologating them, they perform a consistency analysis alignment. Every week they also hold a refinement meeting retrospective, where they point out what was positive, the challenges faced, and the solutions found during the week. There are also daily alignment meetings and biweekly one-on-one meetings between the leader and the

Figure 3.3: Team B agile process



developers. Communication occurs synchronously via Gather⁴ and Microsoft teams, and development can also occur in pairs.

3.2.2 Data Collection and Analysis

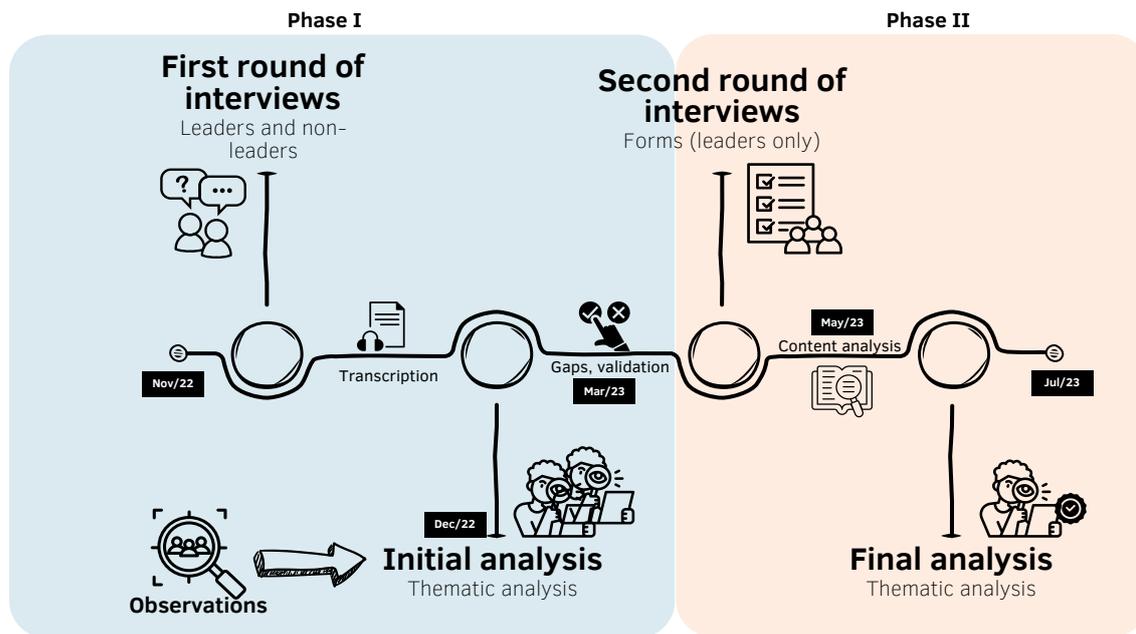
The data collection and analysis process took place between November 2022 and July 2023. We carried out the data collection through semi-structured, structured interviews and observations in two phases, see in Figure 3.4, which shows the process for data collection and analysis.

Phase 1

Initially, we conducted the first interviews synchronously, using two scripts: one for developers who do not consider themselves leaders and another for those who consider themselves

⁴<https://pt-br.gather.town/>

Figure 3.4: Data collection and analysis



leaders. These scripts are based on the results obtained by Gren and Ralph (2022), seen in more detail in the Appendices Caption (Appendice B.1). The scripts served as guides to facilitate the conversations and responses in this research, applied to each participant in the two teams. These interviews were conducted from November to December 2022 via Google Meet⁵ and recorded with AnyMP4 Screen Recorder software⁶, with the interviewees' permission. All participated voluntarily and with the approval of the research project by the local Research Ethics Committee (Annexe D.2). We used the oTranscribe application⁷ to transcribe all the interviews. While the primary researcher (Thesis's author) conducted the interview, the second researcher took notes and made the transcription, which the primary researcher reviewed. The reverse also occurred, with a balance in the number of interviews and transcriptions conducted between the researchers.

In addition to the interviews, we observed the two teams during a sprint (Figure 3.4, Observations) in some meetings and chats (when authorized), where we applied an observation script adapted from Batista (2021). As a means of data collection, observations can complement the process, in this case, of leadership, which occurs naturally, without interference from researchers, allowing visualization of situations described (and not described) by partic-

⁵<https://meet.google.com/>

⁶<https://www.anymp4.com/pt/screen-recorder/>

⁷<https://otranscribe.com/>

participants in interviews (BATISTA, 2021). According to Batista (2021), observations reinforce the consistency of the data obtained in the interviews, bringing the results closer to reality.

For team A, the primary researcher observed four meetings: design session, planning, retrospective and internal synchronization; and also had access to Team A's communication chat. At the same time, the second researcher attended three meetings of Team B: daily, refinement, and retrospective. The primary researcher was also allowed to participate in Team B's retrospective meeting. Both researchers were not allowed to access Team B's chat channels.

We performed an initial analysis for the first interviews and observations. For interviews, we used MaxQDA⁸ in the transcription documents. Like Gren and Ralph, we followed the steps recommended by Braun and Clarke (2006) to perform a thematic analysis. Thematic analysis is a widely used method in psychology where patterns (themes) in qualitative data can be identified, analyzed, and reported (BRAUN; CLARKE, 2006). Thus, Braun and Clarke (2006) suggests six steps for performing thematic analysis: (1) read each transcript (2) highlight all statements broadly related to the concept under investigation (3) sort the highlighted statements into categories (4) name each category (5) for each category, reread all the statements together; (6) reassess the cohesion and the category name.

In the first phase, we applied steps 1 to 4 of the thematic analysis. After the researchers read each other's transcripts (step 1), we obtained 206 initial statements (step 2) by marking all quotes related to effective agile leadership in software development teams in MaxQDA. We then grouped the quotes into categories by naming them (steps 3 and 4). To improve the visualization of the categories, we created concept maps with non-leaders and leaders' views on the research questions under investigation (see AppendicesB.7). This helped us to find meaning in the categories that emerged.

Given this, assessing similarities and differences in the points identified in the interviews and in the observations, we identified possible gaps and doubts, which served as a guide for the elaboration of the questionnaire for the second interviews, aiming at the validation and confirmation with the leaders of what was found in this first phase of collection and analysis.

⁸<https://www.maxqda.com/>

Phase 2

In the second phase, after raising gaps and questions that arose in the first phase of the analysis, we prepared the second interviews (structured) using forms applied to the leaders.

The main reason for using forms was that the researchers' time in the projects teams had expired, which could exceed the time available for analysis when scheduling individual interviews synchronously. We contacted only the leaders to confirm the aspects of leadership identified by the non-leaders, as we believe they are more aware of their leadership roles. Each form was different for each leader, as the team processes were different.

After receiving the responses from the leaders, we performed a simple content analysis, identifying interesting points that connected with the concept maps from the first interviews. After this, we apply the steps 5 and 6 of thematic analyses, refined the categories iteratively, where the researchers audited the categories for consistency. The difference between the content analysis and the thematic analysis, carried out in the second phase of this work, is that the former only made a broader scan over the answers of the forms answered by the leaders, identifying information that could respond to the gaps and validations found in the first phase. This information was incorporated into the thematic analysis, where the categories, after refinement, were related to existing theories in the literature, finalizing the analysis. In Appendix B.6 it is possible to see how the final analysis turned out with the naming and refinement of themes.

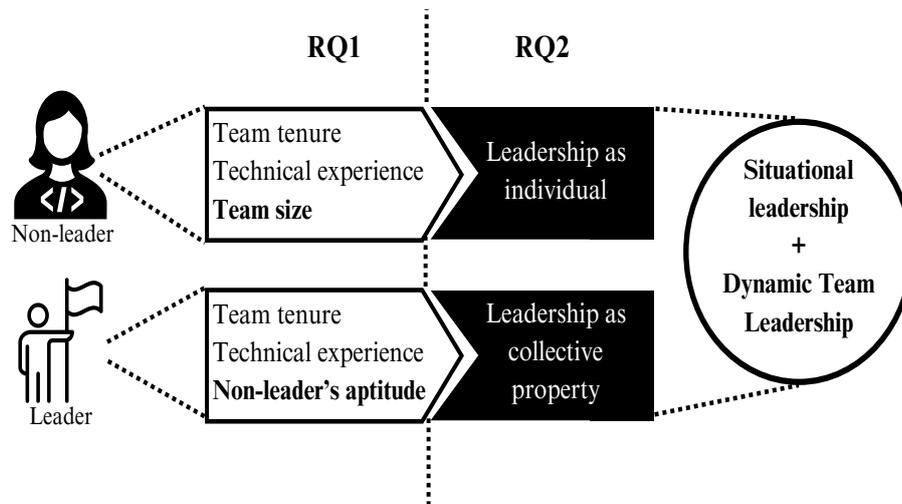
It is not possible to say that there was data saturation; unlike other exploratory studies, those using case studies usually have a set number of respondents, in our case, two teams. In the next Chapter we report the results with the identified themes that answer our research questions.

3.3 Results

The findings of the case study suggest that there are differences (but also some similarities) in the way leaders distribute leadership among non-leaders (RQ1), where the perception of leadership differs between them (RQ2).

Figure 3.5 summarize our findings.

Figure 3.5: Non-Leaders' and Leaders' Perspectives on Leadership.



3.3.1 Non-leaders' Perspective on Leadership and How it is Shared

In the teams studied, the interviews and observations suggest that their leader shares some leadership activities eventually, *based on their team tenure and technical experience, and also based on team size*; when the team was smaller, leadership distribution was promoted. Furthermore, because they recognize the leader's figure as being linked to a named person in the team, their leadership view ends up being focused on this individual figure, who shares leadership in a situational way based on the individual maturity of each one.

Team Tenure, Technical Experience and Team Size

P9, who has only been on the team for a short time, says that his tenure on the team is fundamental for the leader to share some of his responsibilities: *"(...) I don't think (the leader) would give me a role, (...) Because there are people on the team who have been there longer than I am and can deal with it much better than I can."* - P9/B. P6 says that, in the team of graduates and undergraduates, team tenure is a determining factor for the leader to share leadership activities, where she tends to assign responsibilities according to this tenure, where graduates (because they work more hours than undergraduates) receive more responsibilities than them: *"There is a difference about part-time (undergraduates) because she (the leader) generally prefers to assign to full-time (graduates) due to availability. So those of us who are full-time have a better view of what's going on"* - P6/A.

Other interviewees highlight the aspect of technical experience for the leader to share leadership responsibilities: *“Especially when there were problems in the database, as I had experience in this, I was left to decide the pairs (of developers in pair programming), so she (the leader) put me on those stories.”* - P5/A. Another example: *“Only at times did some decisions perhaps carry much weight, taking into account the roles within the team (...) such as someone being responsible for a huge refactoring and the person still being an undergraduate and not having as much (technical) experience in this.”* - P1/A.

During Team A’s internal synchronization meetings and design sessions, we observed a non-leader (P2) with more technical experience and longer tenure substitutes for the leader in his absence. At this specific meeting, she passed on all the information from the design session to the leader and helped her distribute the activities to the rest of the team. This aligns with what was found in the interviews, corroborating that team tenure and experience are relevant factors in deciding who takes on leadership activities based on individual maturity.

In addition, some non-leaders also mentioned that team size influences the sense of belonging related to effective leadership. Similar to our findings, Gren and Ralph (GREN; RALPH, 2022), believe that agile leadership is effective when there is a strong sense of belonging and a common purpose within the team. Two of the non-leaders of Team B also emphasized that, as the team is small, they have a sense of belonging and friendship, which, in their opinion, facilitates collaboration: *“ (...) my team has reached a level where we are so close that when things go wrong, let’s put it that way, we get together and solve the problem (...). So our coexistence is very harmonious (...). I feel part of where I am, and I feel good about it”* - P8/B; *“I think it’s at this time (under pressure) that we see constant conversation and concern for everyone. I think the fact that we’re a small team also contributes a lot because we stick together”* - P9/B. In simpler terms, to the extent that they come together to solve a problem, this clearly expresses characteristics of self-organized teams, which allows the exercise of shared leadership (MOE; DINGSØYR; DYBÅ, 2009; GREN; RALPH, 2022).

A non-leader (P8/B) reported an impediment during the Team B (smaller team) retrospective meeting we observed, and the leader asked her if she knew how to solve the problem. She told her the idea, and the leader said she trusted her. In this sense, it was possible to see that the leader acts in a more guiding way and places trust in the non-leader. Furthermore, in

the same team, in a retrospective meeting, the feeling of hierarchy is minimal among them, and it is possible to perceive a stronger sense of unity and cooperation among the Team B's members, including the leader and non-leaders. In Team A (the largest team), on the other hand, it was observed that in two meetings (design session and daily), the leader was not present, and one of the non-leaders took on the role of team leader. It suggests an aspect of laissez-faire leadership on the part of the leader, where leadership is almost absent (ARAÚJO et al., 2022; BASS; RIGGIO, 2006). P2/A reported this absence: *"Tuesdays and Thursdays are two days that she (the leader) doesn't really enter (the team's communication channels). (...) There are five days in the week, and that's almost half the time we don't have someone really there on a day-to-day basis"* - P2/A.

Leadership View as Individual Function by Non-Leaders

In the teams studied, some non-leaders (P1/A, P3/A, P4/A, P5/A, and P9/B) see leadership as a function linked to an individual, two (P6/A and P10/B) sees leadership as a function but also as a team property, and other two (P2/A, P8/B) consider leadership as a team property. In simpler terms, most have their vision linked to the role of the leader, where, even in self-organized and self-managed agile teams, someone is exercising leadership (GREN; RALPH, 2022).

P1/A, P5/A, and P9/B, for example, explicitly said that they see leadership as a function attributed to an individual: *"I see it as attributed to a person, from the beginning we knew that (the leader) had this function of manager (...)"* - P1/A; P5 and P9 still perceive that, although some people have aspects of leadership, the role of an individual leader is necessary: *"I see it more as a function assigned to one person. So, I believe that various people in our team have aspects and points of leadership, but I think there has to be a leader."* - P5/A; *"I would say that (leadership) belongs to one person. However, I don't think there's anything to stop someone from being a sub-leader, so to speak, in particular, individual processes. But I think the leader, in itself, is individual."* - P9/B.

P6/A and P10/B, non-leaders with a team tenure between one and three years, recognize leadership as a function and also as collective property. In contrast, non-leaders exercise leadership functions (decision-making) at a more operational level: *"We also make some minor decisions, for example, alternative ways of implementing what is being asked (...)"*

when we see that there is a better way of doing it and we always have that freedom to decide. But for me, the real leader is (name of leader).” - P6/A; “(...) Everyone has a voice to put forward their point of view. However, in the end, it’s the leader who decides. But everyone is heard, and everyone’s opinion is considered.” - P10/B.

P2 and P8, on the other hand, are considered to be the non-leaders with the most technical experience and team tenure. In their view, leadership is entirely a collective property of the team: *“I particularly think it’s a property of the team because I believe that you don’t necessarily have to be in a managerial position to take some leadership directive. (...) I believe that it wouldn’t necessarily all have to be associated with a managerial figure (...)” - P2/A; “I’d say it’s more of a team property within agile. Within Agile, you sometimes have to take on roles that require leadership characteristics. So, for example, in the absence of the leader, I sometimes play the midfield leader role. (...) Sometimes you need to put your leadership hat on to get the business moving.” - P8/B.*

However, when asked who is in charge of the team, only P8 (Team B) recognizes that it is the team that is in charge: *“The team. (...) We know that there’s a role for our leader, and we respect that hierarchy, (...) but we need to have that skill and leadership game as well. (...)” - P8/B;* Meanwhile, P2 recognizes the role of his leader: *“In charge of the team, so, speaking in an efficient way (leader’s name)” - P2/A.*

During a Team A grooming meeting, when P2/A was substituting for the leader in his absence, she suggested changing the points in an activity assigned to pair programming between a non-leader with shorter tenure and another with longer tenure. As for Team B, in the refinement meeting, we observed P8/B decided on how to carry out a test task since she is a quality specialist, where she instructed the non-leader on how to proceed with the task. The team leader remained uninterrupted. The evidence suggests that because these two non-leaders are considered to be the most mature in the team, they are able to maintain a leadership experience that is similar to that of the appointed leader.

According to the thematic analysis results, experience and team tenure can be seen as attributes of mature teams, as they may be better equipped to understand and perform their roles effectively (RAMIREZ-MORA; OKTABA, 2018).

The size of the team can also influence the degree of cohesion, in which team members are motivated to be part of the team (RAMIREZ-MORA; OKTABA, 2018). Thus, about

pre-existing leadership theories, the SLT stands out in this sense, as the evidence shows that the non-leaders studied perceive a situational style in their leaders, depending on their level of maturity, in this case, individual, so that they can assume any leadership positions in their teams.

3.3.2 Leaders' Perspective on Leadership and How it is Shared

Among the two formal leaders studied, both also stated that they share some leadership activities based on experience and team tenure too, *but also according to the non-leader's aptitude to carry out these types of activities*. So, they see leadership as a collective property of the team because they can eventually distribute leadership activities among non-leaders.

Team Tenure, Technical Experience and Non-leaders' Aptitude

Team A's leader says that, regardless of their education, members need to have a sense of responsibility and commitment in order to take on leadership activities: *"...there are people in the team who, regardless of whether they are undergraduates or graduates, already have that degree of taking on a story. (...) Some people in the team don't yet have this sense of responsibility or commitment."* - P7/A. Another example: *"More than the developer's experience in the project or previous projects, what was taken into account was the developer's interest in taking on this role in the execution of the project."* - P7/A.

For her, experience and tenure also influence the assignment of leadership activities. However, it is inseparable from the non-leader aptitude to take on such responsibilities: *"...Even one of the project members who had already left (had been on the team for longer) took on the responsibility to take on the role of leader while I was away (...), to try to make life easier for the other members in some development scenarios (...). I asked if she would feel comfortable taking on these responsibilities when I wasn't there, and she said yes. (...) When she left, I talked to another member (also experienced and with more team tenure) to see if she would like to take on this responsibility and (...) I'm seeing what she's doing, taking the lead (...)"* - P7/A.

Team B's leader also emphasizes that it is necessary to "possess leadership skills" so that the non-leader can take on this role with mastery: *"I think leadership is a question of skill*

and maturity, right? You learn about it, you study about it, but if you don't have the skills (...), you can't lead. (...) So, I think that agile leadership is made up of your motivation and your technical leadership, right? (...)." - P11/B.

Experience also counts for this leader, and in the same way as Team A's leader, aptitude is inseparable: *"We have a technical leader... She knows the most about the product. She's passionate. She even has a nickname, right? The person from (project name). So she's the person who's wear the product's shirt (...). She knows the product, she's enthusiastic, she's motivated. Yes, and she has the technical ability with any of the applications, any of the technologies that are in the product (...)."* - P11/B

It was observed during the meetings, and in some of Team A's chat conversations, that one of the more experienced non-leaders, possessing longer tenure, exhibited leadership-related competencies, such as active communication, the ability to solve problems and answer for the team in the absence of the leader (as was observed in the design session and daily meeting), as well as getting on well with all the other non-leader colleagues, generating a feeling of security and companionship.

Similarly, Team B has more experienced non-leaders, i.e., those with greater maturity. This suggests that the more mature the team, the more their members (non-leaders) can take on leadership activities in different aspects of the project (SPIEGLER et al., 2020).

Leadership view as Collective Team Property by Leaders

For both leaders studied, leadership is seen as a collective property of the team, as identified in previous work (GREN; RALPH, 2022; SPIEGLER et al., 2020). In simpler terms, more than a function, the more experienced members in the case study, with leadership aptitudes, can dynamically exercise the leader's activities to guide the team toward its goals (GREN; RALPH, 2022).

Team A's leader explicitly says that she sees leadership as ownership, contributing to a collaborative environment: *"I see it as ownership. In fact, most of what I do is discuss, together we devise a solution. So (...) we discuss and build the solution. Even from the point of view of taking responsibility, I also encourage the staff to do this (...)."* - P7/A. When asked in the second round of interviews about how she sees his leadership, this same leader said that she prefers to keep the process decentralized: *"I see it as a way of keeping more than one*

person aware of the overall vision of the project and aware at a deeper level of detail about what everyone (or most everyone) was working on.” - P7/A. This leads to the characteristic of a dynamic team leader since she exercises her leadership based on a collective idea within a relationship of help, partnership, and trust (FERREIRA, 2021).

Team B’s leader, on the other hand, recognizes the role of one of the non-leaders as a technical leader and developer because she has in-depth knowledge of the product they are developing: *“It’s not just one position, right? (the leadership). There’s a developer who is also, let’s say, an unnamed technical leader. She is the person who knows the most about the product.”* - P11/B. When asked in the second round of interviews what her leadership looks like, P11/B recognized her leadership as situational, but that the objectives are not linked to the role of the leader: *“I exercise a situational leadership, with elements of transformational leadership, but taking care that the idealization of the objectives remains in the cause to be achieved and not linked to the figure of the leader.”* - P11/B. This suggests that, despite considering leadership as situational, the idea of dynamically sharing leadership may remain so they would not be mutually exclusive.

In an internal Team A’s synchronization meeting, dynamic leadership could be seen when, at one point, the leader asked the non-leader (who had taken her place in a previous meeting) for information on task allocation decisions made in previous meetings, corroborating the idea of collaboration present in the DTLT. In a Team B refinement meeting, the leader informed the Producer Owner about more strategic decisions (related to the business plan) and allowed the non-leader (QA specialist) to define backlog activities according to her experience at a more operational level.

In the interview, she also reported an idea of distributing leadership situationally (in levels): *“The sharing of leadership, in my view, should be done in layers of leadership (strategic, tactical, and operational). (...) Operational - technical level, (...) can be delegated and only needs monitoring. At the tactical level, leadership is shared, but decisions require consultation and approval. The strategic ones cannot and should not be delegated because they are actions taken in another company sphere with Product Owner and Business.”* - P11/B.

Thus, for the leaders studied, the perceived type was the same as that found in previous work: leadership in which activities are distributed dynamically among team members

(DTLT), who constantly adjust their shared leadership work to the changes that may arise (GREN; RALPH, 2022). However, it can be seen that the SLT is not exclusive, which leads one to believe that this dynamically shared leadership is done according to the individual maturity of the non-leaders of the teams.

3.3.3 Summarizing the answer to the research questions

RQ1: Are there differences in how leadership is shared by leaders between non-leader team members?

Yes, there are notable differences in perceptions regarding the size of the team and the aptitude of non-leaders to carry out these activities. To clarify, while non-leaders perceive that the distribution of leadership activities varies with the size of the team, leaders highlight non-leaders aptitude as a determining factor for this distribution. However, there are also some similarities in how non-leaders and leaders perceive the distribution of leadership activities based on the length of time non-leaders have been in the team and their technical knowledge.

RQ2: Are there differences in the leadership view between leaders and non-leaders?

Most non-leaders explicitly see leadership as a function assigned to a named person, while leaders see leadership as a collective team property.

3.4 Discussion of the results

The results suggest that are similarities and differences in the way leadership activities are shared, and the differences in views by leaders and non-leaders, converge toward *a perception of leadership as situational and dynamic*, with this convergence being related to the experience and non-leaders team tenure, as well as the size and aptitude of these non-leaders to take on leadership activities. Thus, the results observed in this case study suggest that the identified theories might not be mutually exclusive (see Figure 3.5).

3.4.1 Situational Leadership Theory and Dynamic Team Leadership Theory

In SLT, leaders adjust their style based on team members' readiness and maturity levels (BASSANI; VIEGAS, 2021), Gren and Lindman (GREN; LINDMAN, 2020) identified the challenges that agile leaders face in managing group dynamics. These challenges relate to the adaptability of the leader to the maturity of the team, with newly formed or less mature teams needing more guidance to become agile (and exercise the principle of self-management/organization), unlike more experienced teams, whose leader can adopt a mentoring or facilitating role (GREN; LINDMAN, 2020). This highlight can be compared with the teams studied, bringing the maturity of the non-leaders to a more individualized level; we observed that the leaders are always trying to adapt leadership sharing in a dynamic way (DTLT) with the non-leader members of the team according to their level of maturity (SLT). This dynamic sharing of leadership activities, which has a cyclical and iterative nature (HUANG; JIANG; CHANG, 2023), offers leaders the opportunity to stimulate the individual skills of non-leaders, as well as to develop the team's SLT-related maturity (KOZLOWSKI et al., 2008; HUANG; JIANG; CHANG, 2023).

3.4.2 Non-Leaders' perspective

Another perception identified is that the non-leaders studied, with more experience and/or longer team tenure, who take on leadership activities frequently, perceived leadership as more dynamic (in terms of sharing) and less situational. In this case, situational leadership is exercised by the leader at the support and delegation level (BENMIRA; AGBOOLA, 2021). This allows these non-leaders to actively participate in decision-making and act more independently at operational and tactical levels based on their leadership skills, experience, and team tenure. Therefore, the most mature stages of SLT are a delegation of responsibility and shared leadership (BASSANI; VIEGAS, 2021), suggesting the idea that SLT complements DTLT.

Similarly, less experienced non-leaders with shorter team tenure in both teams, who do not take on leadership activities frequently, perceive leadership as more situational and less dynamically shared among the team. According to the results, the less mature non-leaders

studied tend to benefit from leadership assigned to an individual, generating greater trust among them, which ultimately allows them to make decisions with more confidence over time (HERSEY; BLANCHARD; NATEMEYER, 1979; SPIEGLER et al., 2020; GREN; LINDMAN, 2020). Even though agile methodologies, in their early stages, are geared towards self-managing teams that promote minimal interference from traditional managers or leaders, (KOZLOWSKI et al., 2008) (GREN; RALPH, 2022); previous research has suggested that the presence of leaders who define and reinforce team expectations can be advantageous (KOZLOWSKI et al., 2008), (GREN; RALPH, 2022), (SPIEGLER et al., 2020).

3.4.3 Differences between Leaders and Non-Leaders' Leadership View

It was also possible to identify some patterns between the two teams studied that show divergences between leaders and non-leaders in how they view leadership. In Team A (larger team size), comprised of seven members, its non-leaders vary from experienced or with more team tenure to less experienced or with less team tenure. It can be seen that its leader perceives leadership as related to DTLT, and the majority of its non-leaders perceive leadership as related to STL. In Team B, on the other hand, made up of four members, where most of the non-leaders are experienced and have more outstanding team tenure, it was possible to see that their leader sees leadership as related to SLT and that this situational characteristic determines how they share leadership activities dynamically (DTLT), the latter being noticed by their more experienced non-leaders, as explained above. One possible hypothesis is that *the team size and the non-leaders' maturity may contribute to the leader's tendency to be situational or dynamic*. Future research could assess the viability of this hypothesis.

Based on the assumption that leaders and non-leaders view leadership differently, although leaders may be inclined to empower non-leaders to make decisions and allocate responsibilities according to their respective experiences and skills, challenges arise because, as identified in the results, not all non-leaders possess leadership skills (AMIT et al., 2009). One possible explanation for this difference is that since these non-leaders may be more task-oriented than leadership-oriented (MONAGHAN et al., 2015), (MEYER et al., 2014), especially if the leadership they receive has a more transactional style (BASS; RIGGIO, 2006; ARAÚJO et al., 2022), they may focus more on tasks and tangible results (MEYER et al., 2014), without fully considering leadership-related activities. When we compare sit-

uational leadership with the transactional style, we realize that by emphasizing the task itself (ARAÚJO et al., 2022), this style suits situational leadership when the leader directs and guides non-leaders, offering rewards to followers and focusing on goals (KIRKBRIDE, 2006). In addition, if they have no previous experience of leadership or theoretical knowledge about it, their perception of hierarchy (leader-leadership) may be sharper, leading them to see leaders as responsible for giving orders and making decisions (AMIT et al., 2009), without fully considering the complexity of flexible leadership styles (ARAÚJO et al., 2022).

For non-leaders studied, with leadership skills, situational leadership aligns with a more transformational style, in which the leader focuses on the personal needs of those they lead (ARAÚJO et al., 2022). For Walls (WALLS, 2019), situational leadership relates to transformational leadership concepts by adopting flexibility, recognizing that situations can change and new needs can arise during the development process (WALLS, 2019). This corroborates the results, in which these non-leaders recognize their appointed leader, who, in this case, tends to direct and guide rather than support or delegate, as set out in SLT (HERSEY; BLANCHARD; NATEMEYER, 1979). These assumptions may vary according to the specific organizational context and the individual characteristics of the non-leaders involved. A more in-depth approach is therefore required through additional research to explore and confirm these possible explanations.

3.5 Implications

For SE Academy

The findings provide a basis for exploring integrating situational leadership (SLT) and team dynamics (DTLT) theories, suggesting that these approaches can be complementary. This expands teaching and research opportunities on shared leadership, considering factors such as team maturity, size, and experience. Furthermore, the results highlight the need to include non-leader perspectives in leadership analysis, expanding the understanding of the concept as a team property rather than an individual attribute.

For SE Research

This study reinforces the relevance of investigating how differences in perceptions between leaders and non-leaders influence software development processes. The divergence of views identified raises hypotheses about possible impacts on activities such as sprint planning, conflict resolution, technical decisions, and scope changes. Future research can explore how these differences and factors, such as team size and maturity, affect software quality and maintainability, generating practical insights for improving leadership in agile teams.

For SE Industry

For organizations using agile methodologies, the results suggest that leaders should adapt their style based on members' maturity and experience level, especially in teams of varying sizes. Integrating situational and dynamic approaches can improve planning, conflict resolution, and decision-making. Additionally, considering the perspectives of non-leaders can facilitate collaboration and promote continuous improvements in software development

3.6 Threats to Validity

3.6.1 Construct Validity

Regarding the issue of construct validity, the data collection tools were adapted to capture non-leaders perspectives on leadership based on previously validated research on leadership in software teams. In the thematic analysis phase, the presence of two researchers during data collection helped to reduce researcher bias. However, limitations were identified, such as simultaneous observation of meetings and restricted access to team communication channels. However, other sources of bias may not be completely mitigated, such as the researchers' subjective interpretation of the qualitative data. Furthermore, the presence of undergraduate participants may compromise the results, since they may have a different view of the context in which only undergraduates are inserted.

3.6.2 Internal Validity

Internal validity was also addressed by the second researcher during the data collection and analysis process. However, some limitations remain, such as the impossibility of observing all the meetings simultaneously. A second round of interviews with the leaders was conducted to mitigate this bias and confirm the preliminary results. However, there may be response bias on the part of the interviewees, who may adapt their answers based on their perceptions of what the researchers want to hear or due to the context of the research.

3.6.3 External Validity

External validity refers to the generalizability of our results. They cannot be generalized to all software development teams, although the insights are certainly valuable for agile teams with situational or dynamic leaders with transformational and transactional styles. In addition, we recognize that cultural differences may play an important role in the results, as we have focused here on two Brazilian software teams. Generalization to other cultures or types of teams should be done with caution, and more studies are needed to assess whether the results apply in different cultural and organizational contexts.

3.7 Conclusion of the Chapter

The results obtained in this chapter provided in-depth information about the participants' perceptions and experiences regarding leadership in software development teams. However, they do not allow for propagation to a broader population. Thus, the need for the study presented in the next chapter is justified, enabling confirmation and deepening of the qualitative findings in a larger sample. With a quantitative approach, it is possible to identify the magnitude and significance of the differences observed between leaders and non-leaders, providing more robust evidence for the interpretations constructed in this Chapter. Thus, the integration of qualitative and quantitative methods enriches the understanding of the phenomenon investigated, strengthening the consistency and applicability of the results.

Chapter 4

A Survey on Leadership Styles in Agile Software Teams

4.1 Purpose

Since the previous study consisted of a case study that qualitatively assessed the perspectives of leaders and non-leaders on the differences and similarities in the sharing of leadership activities, the main objective of this second study is to expand the research by assessing more generally and quantitatively how individual and contextual factors influence leadership perceptions and practices. In addition, we seek to test some of the hypotheses raised in the previous case study, providing a more comprehensive analysis of the topic.

The previous study identified that factors such as team tenure, experience, team size, and aptitude are factors for leadership assignment by the leader. These factors were used as variables for this study. In addition to these, during the observations of the case study (Chapter 3), leadership attribution situations were identified, where the leader could assign leadership activities to non-leaders. For this study, we illustrate them with the following vignettes (V):

- a) **V1 - Temporary leadership:** occurs when the leader is absent from the team for a period of time, for example, during a vacation, and a non-leader needs to take over in full.
- b) **V2 - Leading a meeting:** occurs when a non-leader takes over the running of a meet-

ing, with or without the leader present - for example, retrospective meetings, alignment meetings, and others.

- c) **V3 - Decision-making:** occurs when the non-leader makes an important decision regarding the development process, and the whole team accepts this decision - for example when the non-leader presents some technology that will be developed.
- d) **V4 - Backlog definition:** occurs when the non-leader (with or without the presence of the leader) defines some important activity that will go into the backlog, either for a short period (e.g., sprint backlog) or for a more extended period (e.g., product backlog).

V1 can be classified as a more structured and centralized activity, in contrast to the activities described in V2, V3, and V4. V1 focuses on delegating leadership responsibilities more formally, expecting the leader to take on a clear role, which tends to involve greater control. Unlike the other vignettes, where activities are more collaborative and distributed, V1 reflects (although it does not indicate) a hierarchical approach, where the leader exerts more significant influence over the assignment of tasks and decisions. These vignettes are also used in the quantitative analyses to answer the following RQ:

RQ3: What is the relationship between factors for leadership assignment of leadership activities and leadership style perceived by leaders and non-leaders?

The purpose of this RQ is to identify whether there are significant associations between factors for leadership assignment and the leadership style perceived or adopted by leaders and non-leaders. It can help to understand whether certain leadership styles influence the practices of leaders of agile software development teams in assigning responsibility. Also, it could contribute to more effective leadership interventions and to the design of leadership development programs that are better aligned with organizational needs.

RQ4: Are there differences between leaders' and non-leaders perceptions of factors for assigning certain leadership activities?

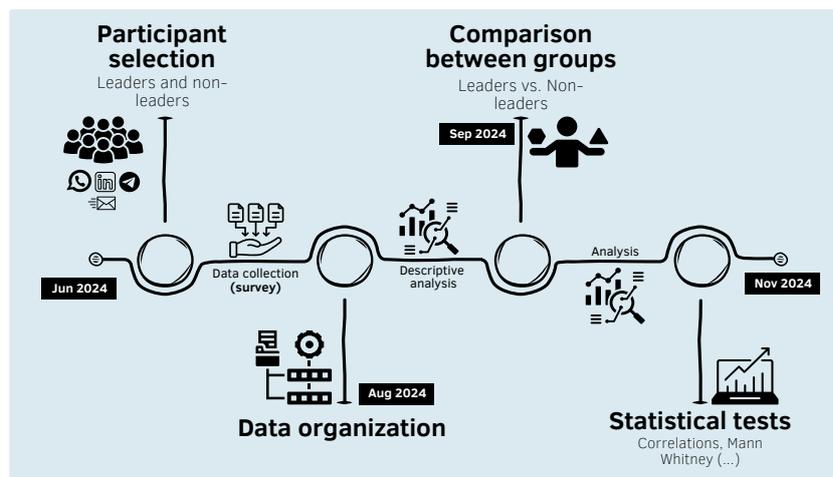
This RQ aims to investigate whether there are significant differences between the perceptions of leaders and non-leaders about the factors considered when attributing certain leadership activities (vignettes). This analysis seeks to determine whether leaders and non-leaders evaluate these factors differently when assigning leadership activities. The findings

will be compared with the results of the previous qualitative study, assessing how leadership is perceived in the context of agile SE teams.

4.2 Methodology

Figure 4.1 shows the process for data collection and analysis.

Figure 4.1: Data Collection and Analysis



Between July and August 2024, participants were selected, followed by data collection through a survey and organization of the collected data. Data analysis began shortly thereafter, with the comparison between leaders and non-leaders (September 2024) and statistical analyses that ended in November 2024.

4.2.1 Participants

The study sample consists of 111 Brazilian developers working in agile software development teams, selected through a non-probabilistic approach that combines convenience and snowball sampling strategies in Brazil. This methodology, also known as unpurposive sampling (Baltes & Ralph, 2022), was chosen to facilitate access to participants and increase the number of responses obtained efficiently and cost-effectively (BALTES; RALPH, 2022; OLIVEIRA et al., 2023).

Developers were recruited through contact hubs and outreach campaigns, such as posts in social media groups (Whatsapp, LinkedIn, and Telegram), flyers, and banners, used to

achieve greater diversity in the sample. The snowball strategy was essential to create a progressive recruitment network in which participants indicated other potential respondents, expanding the scope of the research. This approach allowed us to obtain a significant number of responses without needing a formal sampling structure. To minimize sampling bias, we indicated that those professionals who work in agile teams, where the development process is similar to other agile teams in Brazil and around the world, could respond (MELO et al., 2013).

For this study, the role of software developer encompasses professionals such as programmers in a wide variety of roles (front-end, back-end, full stack), designers, software architects, testers, database administrators, research and development professionals, DevOps specialists, security professionals, data analysts, scientists and students in the field. If these professionals are in leadership roles, they range from technical team leaders to IT managers, coordinators, and directors.

4.2.2 Study Instrument

Our questionnaire was divided in three parts: demographic questions, the Multifactor Leadership Questionnaire (MLQ) and vignettes. The questionnaire can be found in Appendix C.1.

1st Part: Demographic Questions

For demographic questions, we asked about age, gender, education, and the participant's position in the team (whether leader or non-leader). If they were a leader, they would choose one of the team role options (tech leader, project manager, coordinator, or engineering management), the same for the non-leader option, with roles of developer, researcher, student, tester, data scientist, and DevOps. So, we asked: *What is your age group?* (ranging from under 18 to over 55 years old); *What is your gender identity?* (whether female, male, non-binary, genderqueer, or gender non-conformist, if you prefer not to say, or in your own words); *What is your education level?* (incomplete or complete higher education, master's or doctorate); *What is your current position?* (whether leader or non-leader, each with the options mentioned above).

We also asked about their experience in the team the participant was part of, such as team

tenure, professional experience, and team size. In the questionnaire, to find out the team tenure, we asked *How long have you been on your current team?* (ranging from less than 1 year to more than 5 years); To find out about experience: *How long have you been working on software development teams?* (ranging from less than 1 year to more than 30 years) and; To find out about the team size: *How big is your current team (number of members, including you)?* (ranging from less than 3 or more than 9 people).

2nd Part: The Multifactor Leadership Questionnaire

The second part consisted of the MLQ. It assesses transformational, transactional, and passive/avoidant (PAVL) leadership styles, including laissez-faire (ARAÚJO et al., 2022), based on the Full Range Leadership Model (FRLM) (BERNARD, 1999), as detailed in Section 2.2.3. Developed by Bass in 1985 (BASS, 1985), the MLQ is widely regarded as a benchmark tool for evaluating leadership styles. It comprises 21 questions on a 5-point Likert scale (HARTOG; MUIJEN; KOOPMAN, 1997), measuring factors (or characteristics) that define leadership styles, which can vary across studies (HARTOG; MUIJEN; KOOPMAN, 1997). These variations have led to multiple versions of the MLQ (ARAÚJO et al., 2022). For this study, version 6S was selected due to its accessibility, validity, and reliability (BASS; AVOLIO, 1992; BASS; AVOLIO, 1996). Table 4.1 presents the factors associated with each leadership style and how the MLQ-6S accounts for the questions (BASS; AVOLIO, 1992).

Table 4.1: Style, FRLM Factors and MLQ account

Style	Factor	Summed MLQ Items
Transformational	Idealized Influence	1, 8, 15
	Inspirational Motivation	2, 9, 16
	Intellectual Stimulation	3, 10, 17
Transactional	Individualized Consideration	4, 11, 18
	Contingent Reward	5, 12, 19
	Management by Exception	6, 13, 20
Passive/Avoidant	Laissez-faire	7, 14, 21

Additionally, it was translated into Portuguese, with verb tense adjustments to allow developers to respond based on the leadership they exercise and/or perceive. For example,

in the questionnaire, questions 3, 10, and 17 (Table 4.1) measure the Intellectual Stimulation factor, referring to TFL (with answers on a 5-point Likert scale): 3 - *My leader allows me to think about old problems in new ways*; 10 - *My leader gives me new ways of looking at intriguing things*; 17 - *My leader makes me rethink ideas that I had never questioned before*.

3rd Part: Additional Questions (Vignettes)

The third part of the questionnaire included four additional questions based on leadership attribution situations (vignettes) and common factors in agile software development teams. In these questions, participants assessed the importance of factors contributing to each situation (with answers on a 5-point Likert scale). For example, in the questionnaire, the question related to V1: *Assume the following situation: Your leader is on vacation, and one of your colleagues has been chosen to take over this position during this period. This colleague maintains constant communication with everyone during your leader's absence, ensuring everyone is clear about their activities and responsibilities, monitoring progress, and informing the leader if any intervention is needed. In addition, he/she ensures the team's self-management and organization of work. He/she is prepared to resolve conflicts and unforeseen events, ensuring the team continues functioning efficiently and cohesively during this period. How important were the factors below that led your leader to choose this developer?*

The question related to V2: *Assume the following situation: Your leader is a present and empathetic leader. You are not afraid to ask any questions and feel comfortable in his/her presence. In a retrospective meeting, he/she made it clear that one of your colleagues has full ownership of what you are developing and that this colleague can respond to the team in his/her absence. During these retrospective meetings, it is clear that everyone is committed to the project objectives, ensuring that the work continues aligned and effectively, even in the absence of the leader. How important are the factors below for the leadership to have expressed themselves in such a way about this developer?*

The question related to V3: *Consider the following situation: One of your fellow developers reported an impediment during the refinement meeting. The leader asked if she knew how to solve the problem. She shared her idea for a solution. The leader accepted the idea and said he trusted her. Everyone on the team was present, and their colleagues observed*

her proactivity in identifying and solving problems. How important were the factors below for the leadership to have expressed themselves in such a way about this developer?

The question related to V4: *Consider the following situation: In a daily meeting, the leader reported that he had discussed some strategic decisions with the PO (Product Owner) (related to the business plan). Based on these decisions, the leader assigned one of his colleagues (a testing specialist) to define the activities in the sprint backlog for the next planning meeting. In this meeting, she illustrated the sprint planning with task allocation and priority setting, demonstrating commitment to the project objectives. In addition, the entire team could reflect on prioritizing tasks and redefinition of scope needed to align the work with the strategic decisions discussed. How important were the factors below for the leadership to have made this choice?*

The Pilot and The Final Version of the Questionnaire

Once the questionnaire was finished, a pilot survey was applied with 17 Brazilian developers (14 non-leaders and 3 leaders) from three agile development teams. We collected feedback from those respondents, which was used to refine some of the questions. After these adjustments, the final survey was distributed to new developers through the hub and groups on Telegram, LinkedIn, and WhatsApp, as well as through personal contacts with developers in companies and university labs involved in R&D projects through flyers and banners. Finally, the instrument's reliability (MLQ-6S) was deemed satisfactory, with a Cronbach's alpha of 0.905 and a 95% confidence interval calculated in the final version of the questionnaire, indicating excellent internal consistency of the questionnaire items for leaders and non-leaders.

4.2.3 Procedure and Measurement

We used the RStudio tool¹ for data processing and analysis. In addition, we used the help of Julius AI (Artificial Intelligence)², an AI data analyst who complemented the analysis and visualization of demographic data. Initially, we split the data into two datasets, one for leaders and another for non-leaders. Next, we calculated the leadership factor scores for each dataset, where each factor is determined by the sum of specific questionnaire items (as

¹<https://posit.co/download/rstudio-desktop/>

²<https://julius.ai/>

indicated in Table 3.1), following the recommendation of the MLQ-6S (BASS; AVOLIO, 1996). The data were considered non-normal since the sample size was unequal between the two groups. This could introduce biases or complicate the application of parametric tests that assume normality and homogeneous variance between groups (SHMULLER, 2019, in portuguese). For leadership perception by leaders and non-leaders classification, we used Fisher's test (WARNER, 2013), which can assess the association between two categorical variables, especially when the sample size is small.

To address RQ3, we followed the same procedure used in the paper published at SBES 2022 (ARAÚJO; MASSONI; GREN, 2024), summing and comparing the questionnaire items. First, we verified the scoring scale defined in the MLQ-6S for leadership style factors: *high* = 9 to 12; *moderate* = 5 to 8; *low* = 0 to 4. Then, we calculated the average scores for each leadership style, as indicated by the FRLM, to identify the predominant style. Finally, we compared the results (Table 4.2).

Table 4.2: Style Comparisons

Conditions	Leadership Style
TFL > TSL & TFL > PAVL	TFL
TSL > TFL & TSL > PAVL	TSL
PAVL > TFL & PAVL > TSL	PAVL
(TSL = TFL) < PAVL	PAVL
(TFL = PAVL) < TSL	TSL
(TSL = PAVL) < TFL	TFL
TFL = TSL = PAVL	indeterminate

If the average score for the TFL style was higher than the averages for the TSL and PAVL styles, the respondent was classified as having the TFL leadership style; the same criterion was applied to the other styles. In cases where the average scores of the three leadership styles were identical, we considered the predominant style undetermined. Thus, this study's final sample consisted of 111 valid responses (35 leaders and 76 non-leaders).

To assess the correlation between the leadership assignment factors (team tenure, experience, team size, and aptitude for leading) and the perceived leadership style (RQ3), we used Spearman's correlation test (AL-HAMEED, 2022), as the variables are ordinal and the samples were considered small (LIRA, 2004, in portuguese). Correlations were calculated

separately for leaders and non-leaders to identify how each group associated the analyzed factors with different leadership styles. We also considered *p-value* assuming $\alpha = 0.05$. The hypotheses for RQ3 were:

- a) Null hypothesis (H_0): There is no significant correlation between the leadership attribution factors and the perceived leadership styles for leaders or non-leaders;
- b) Alternative hypothesis (H_1): There is a significant correlation between at least one of the leadership attribution factors and any of the perceived leadership styles for leaders or non-leaders.

Concerning RQ4, we carried out difference tests between the groups (leaders and non-leaders). Mann-Whitney tests were applied to explore significant differences between them. This test was chosen because it is non-parametric and suitable for comparing the distributions of two independent groups (MACFARLAND et al., 2016). The analyses were carried out on (i) the vignettes identified in the previous study, where leadership attribution activities occur from leaders to non-leaders, and (ii) leadership attribution factors, both mentioned above. The hypotheses for RQ4 were as follows:

- a) Null hypothesis (H_0): The two distributions are equal, which means that there is no difference between leaders and non-leaders;
- b) Alternative hypothesis (H_1): The distributions are different, meaning that there is a difference between the perceptions of leaders and non-leaders.

In cases where statistically significant differences were identified (*p-value* < 0.05), the effect size was calculated using Cohen's *d* to assess the practical magnitude of the differences observed (BECKER, 2000). The entire analysis replication kit is available in Appendix C.2

4.3 Results

The data analysis revealed important results about leadership styles and perceptions between leaders and non-leaders, highlighting both convergences and significant differences in factors related to leadership styles and leadership attribution factors. This section presents these

results, starting with the demographic data of the sample participants. Next, general data regarding the distribution of perceived leadership by leaders and non-leaders are presented, followed by correlations between styles and attributional factors (RQ3) and differences between the groups of leaders and non-leaders (RQ4).

4.3.1 Sample Demographic Data

The following Tables shows the participants' demographic data, separated into leaders (total of 35) and non-leaders (total of 76). Table 4.3 compares leaders and non-leaders regarding age, gender identity, education and role.

Table 4.3: Sample Demographic Data

Age					
Leaders			Non-Leaders		
Age (years)	Frequency	Percent	Age (years)	Frequency	Percent
26-35	16	45.7	18-25	54	71.0
18-25	11	31.4	26-35	18	23.6
36-45	7	20.0	36-45	4	5.2
46-55	1	2.8	46-55	0	0.0
Gender identity					
Leaders			Non-Leaders		
Gender	Frequency	Percent	Gender	Frequency	Percent
Men	27	77.1	Men	48	63.1
Women	8	22.8	Women	28	36.8
Education					
Leaders			Non-Leaders		
Education	Frequency	Percent	Education	Frequency	Percent
Graduate	17	48.5	Undergraduate	37	48.6
Master degree	15	42.8	Graduate	32	42.1
Undergraduate	2	5.7	Master degree	6	7.8
Ph.D.	1	2.8	Ph.D	1	1.3
Role					
Leaders			Non-Leaders		
Role	Frequency	Percent	Role	Frequency	Percent
Tech leader	24	68.5	Developer	47	61.8
Project manager	6	17.4	Research and dev.	12	15.7
Coordinator or CTO	3	8.4	Student	9	11.8
Eng. manager	2	5.7	QA/tester	3	3.9
-	-	-	Data scientist or ML	3	3.9
-	-	-	DevOps	1	1.3

Leaders tend to be older, with most aged between 26-35 years, while non-leaders are predominantly younger, with the majority falling in the 18-25 age range. Gender representation among leaders is heavily skewed, with 77.1% being men and only 22.8% women. Non-leaders have a more balanced, though still male-dominated, distribution, with 63.1% men and 36.8% women. Educational attainment also varies significantly between the two groups. Leaders generally have higher qualifications, with nearly 50% holding a graduate degree and

42.8% having a master's degree, while only a tiny fraction hold undergraduate degrees or Ph.D.. In contrast, non-leaders are more likely to have undergraduate degrees (48.6%), with fewer holding master's degrees (7.8%) or Ph.D. (1.3%), suggesting leaders tend to be more highly educated.

Table 4.4 summarizes the distribution of leaders and non-leaders based on their team tenure, overall experience, and team size in which leaders and non-leaders worked when they answered the questionnaire.

Table 4.4: Team Information

Team Tenure (in years)					
Leaders			Non-Leaders		
Time	Frequency	Percent	Time	Frequency	Percent
1-3	19	54.2	1-	37	48.6
1-	8	22.8	1-3	34	44.7
3-5	6	17.1	3-5	3	3.9
5+	2	5.7	5+	2	2.6
Developers Experience (in years)					
Leaders			Non-Leaders		
Experience	Frequency	Percent	Experience	Frequency	Percent
3-6	14	40.0	1-3	30	39.4
6-9	7	20.0	3-6	27	35.5
1-3	5	14.2	1-	11	14.4
15+	5	14.2	6-9	3	3.9
12-15	2	5.7	12-15	2	2.6
9-12	2	5.7	9-12	2	2.6
-	-	-	15+	1	1.3
Team Size (n members)					
Leaders			Non-Leaders		
Size	Frequency	Percent	Size	Frequency	Percent
9+	18	51.4	5-9	34	44.7
5-9	13	37.1	9+	29	38.1
3-5	4	11.4	3-5	13	17.1

Leaders generally have 1-3 years on their current teams, with 54.2% falling into this category, while 22.8% have been on the team for a year or less, and only 5.7% have been with their teams for over five years. In comparison, non-leaders show a similar pattern, with

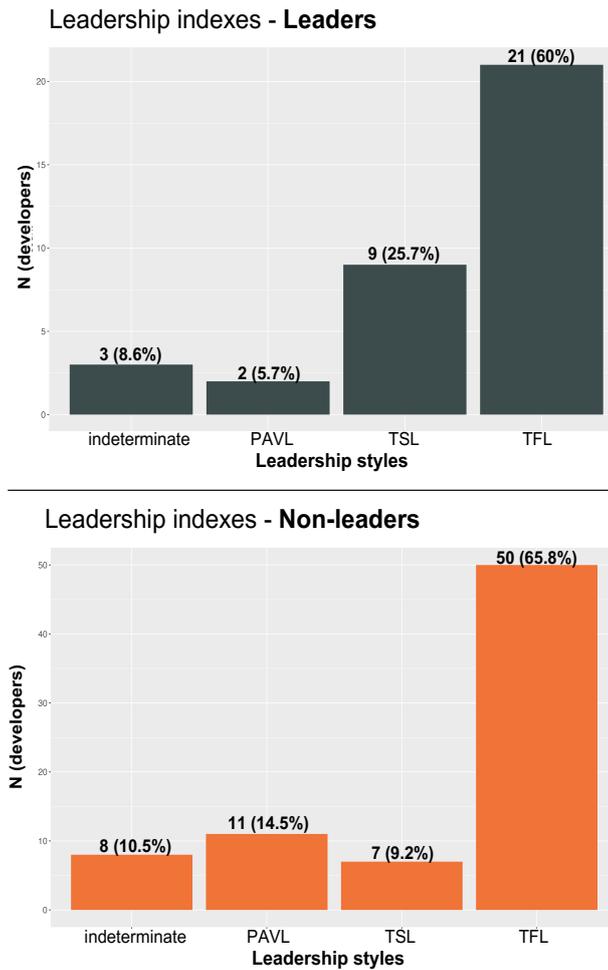
48.6% having 1-3 years on their team and 44.7% having a year or less, but fewer non-leaders remain on the team beyond five years.

Experience levels vary, with 40.0% of leaders having 3-6 years of experience and 20.0% with 6-9 years. Few leaders have more than 15 years of experience. Non-leaders follow a comparable distribution, with the largest group (39.4%) having 3-6 years and 35.5% with 6-9 years. In terms of team size, over half of the leaders work in teams of 9 or more members, while non-leaders are more evenly spread across teams of 5-9 members and teams of 9 or more. Only a small proportion of both groups work in smaller teams of 3-5 members.

4.3.2 Overview About Leadership Styles - Leaders and Non-leaders

The classification of leadership styles, based on the FRLM, revealed differences in the proportions of each style between leaders and non-leaders. Figure 4.2 shows the classifications of leadership styles for both groups, including the “indeterminate” classification, which occurs when there is equality between two or more styles. For leaders, the figure shows the count of individuals who fall into each style, while for non-leaders, it shows how they perceive their leaders’ styles. The percentages refers to the total of each group (35 leaders and 76 non-leaders)

Figure 4.2: Leadership Indexes Classification



The TFL style predominated in both groups, identified by 60% of the leaders and perceived by 65.8% of the non-leaders. This suggests a shared appreciation for this leadership style's inspirational and motivational characteristics. The TSL style showed a clear difference between the two groups, perceived by 25.7% of the leaders and only 9.2% of the non-leaders. This difference reflects the greater identification of leaders with reward and goal-oriented practices than non-leaders. The PAVL style was more frequent among non-leaders (10.5%) than leaders (5.7%), indicating that these characteristics are more noticeable to those who do not exercise formal leadership. The indeterminate style, which combines characteristics of different styles, was relatively rare, with 8.6% among leaders and 3% among non-leaders.

Fisher's test (p -value = 0.1125) did not indicate a statistically significant difference between leaders and non-leaders regarding leadership style classifications. However, Leaders

identify more with the TFL and TSL styles, while non-leaders tend to perceive the TFL and PAVL styles more frequently.

4.3.3 RQ3 - Correlations between leadership assignment factors and perceived leadership styles by leaders and non-leaders

The correlation analysis between the leadership styles (TFL, TSL, and PAVL) and the leadership attribution factors (team tenure, experience, team size, and aptitude) revealed distinct patterns between leaders and non-leaders. Table 4.5 shows the correlations between leadership styles (TFL, TSL, and PAVL) and leadership attribution factors (team tenure, experience, team size, and aptitude) for the **leaders group**.

Table 4.5: Correlations and significance between leadership styles and attribution factors **for leaders**.

Leadership Style	L. Assignment Factors	Corr. (ρ)	p-value (p)
Transformational	Team tenure	0.05	0.847
	Experience	0.14	0.703
	Team Size	- 0.18	0.670
	Aptitude	0.04	0.826
Transactional	Team tenure	0.04	0.696
	Experience	0.1	0.448
	Team Size	- 0.05	0.821
	Aptitude	- 0.08	0.816
Passive/Avoidant	Team tenure	0.15	0.636
	Experience	0.06	0.618
	Team Size	0.27	0.270
	Aptitude	- 0.15	0.370

*p-value assuming $\alpha = 0.05$

As observed, the analysis revealed that all correlations were weak and not statistically significant. For the TFL style, no significant relationships were identified with team tenure, experience, team size, or aptitude. The same pattern was observed for the TSL style, where correlations with these factors remained weak and insignificant. Similarly, the PAVL style showed no significant association with any leadership attribution factors within the leader group. These findings suggest that leadership styles exert minimal influence on how leaders delegate leadership activities based on these specific variables.

Table 4.6 shows the correlations between leadership styles (TFL, TSL, and PAVL) and leadership attribution factors (team tenure, experience, team size, and aptitude) for the **non-leaders group**.

Table 4.6: Correlations and significance between leadership styles and attribution factors for non-leaders.

Leadership Style	L. Assignment Factors	Corr. (ρ)	p-value (p)
Transformational	Team tenure	0.39	0.00016
	Experience	0.27	0.023
	Team Size	0.26	0.028
	Aptitude	0.01	0.096
Transactional	Team tenure	0.44	0.00010
	Experience	0.31	0.011
	Team Size	0.28	0.016
	Aptitude	0.16	0.094
Passive/Avoidant	Team tenure	0.39	0.080
	Experience	0.24	0.881
	Team Size	0.27	0.148
	Aptitude	0.16	0.333

*p-value assuming $\alpha = 0.05$

For the non-leaders, regarding the **TFL style**, a positive and significant correlation was found for **team tenure** ($\rho = 0.39$; $p = 0.00016$), indicating that the more transformational the leader is perceived to be, the greater the attribution of leadership activities to non-leaders with more time on the team. For **experience**, the correlation was weak but significant ($\rho = 0.27$; $p = 0.023$), suggesting that the more transformational the leader is perceived to be, the more experience of non-leaders is considered when attributing leadership activities. For **team size**, a positive and significant correlation was observed ($\rho = 0.26$; $p = 0.028$), suggesting that the more non-leaders perceive the transformational style in their leaders, the more these leaders tend to assign leadership activities based on team size. No significant correlation was found for aptitude ($\rho = 0.014$; $p = 0.0963$), indicating that this factor does not play a significant role in the attribution of leadership activities.

For **TSL style**, the same trend was observed: a significant positive correlation for **team tenure** ($\rho = 0.44$; $p = 0.00010$), suggesting that non-leaders tend to attribute leadership activities based on how long they have been on the team when they perceive a transactional style in their leaders. For **experience**, a moderate and significant positive correlation was

observed ($\rho = 0.31$; $p = 0.0115$), indicating that non-leaders also consider experience in the attribution of leadership activities when they perceive a transactional style in their leaders. Similarly, for **team size**, a positive and significant correlation was found ($\rho = 0.28$; $p = 0.0161$), indicating that non-leaders perceive that transactional leaders assign leadership activities based on the size of the team. No significant correlation was found for aptitude ($\rho = 0.16$; $p = 0.0946$), suggesting that aptitude does not significantly affect the attribution of leadership activities.

For the PAVL style, no significant correlations were found for team tenure ($\rho = 0.39$; $p = 0.0803$), experience ($\rho = 0.24$; $p = 0.881$), team size ($\rho = 0.27$; $p = 0.148$), or aptitude ($\rho = 0.16$; $p = 0.3336$).

4.3.4 RQ4 - Differences between leaders and non-leaders perceptions about leadership activities assignment factors in different activities (vignettes)

The descriptive analyses reveal important differences between leaders and non-leaders about the factors associated with the leadership vignettes. Below, Tables 4.7 and 4.8 present the statistics (mean, median, standard deviation - sd - minimum and maximum values) for each vignette associated with the attribution factors for leaders and non-leaders, respectively.

Table 4.7: Descriptive statistics for factors associated with vignettes (**Leaders**).

Vignette	Factor	Mean	Median	SD	Min-Max
V1 - Temporary leadership	Aptitude	3.8286	4	0.3824	3 - 4
	Experience	2.9714	3	1.0142	0 - 4
	Team Size	1.5143	1	1.1725	0 - 4
	Team Tenure	2.5714	3	1.1704	0 - 4
V2 - Leading a Meeting	Aptitude	3.6286	4	0.6897	1 - 4
	Experience	3.0857	3	0.9509	0 - 4
	Team Size	1.3429	1	1.1099	0 - 4
	Team Tenure	2.8000	3	1.2319	0 - 4
V3 - Decision-Making	Aptitude	3.3714	4	1.0025	0 - 4
	Experience	2.7143	3	1.2022	0 - 4
	Team Size	0.6571	0	0.9056	0 - 3
	Team Tenure	1.9143	2	1.2689	0 - 4
V4 - Backlog definition	Aptitude	3.6857	4	0.7960	0 - 4
	Experience	3.0000	3	1.0572	0 - 4
	Team Size	1.1429	1	1.2161	0 - 4
	Team Tenure	2.6286	3	1.3951	0 - 4

Table 4.8: Descriptive statistics for factors associated with vignettes (**Non-leaders**).

Vignette	Factor	Mean	Median	SD	Min-Max
V1 - Temporary leadership	Aptitude	3.6974	4	0.6329	0 - 4
	Experience	3.3158	4	0.9268	0 - 4
	Team Size	1.7105	2	1.3248	0 - 4
	Team Tenure	3.0395	3	0.9010	0 - 4
V2 - Leading a Meeting	Aptitude	3.4737	4	0.7912	0 - 4
	Experience	3.3158	4	0.8976	0 - 4
	Team Size	1.5789	2	1.4072	0 - 4
	Team Tenure	2.8947	3	0.9740	0 - 4
V3 - Decision-Making	Aptitude	3.4079	4	0.8821	1 - 4
	Experience	3.0000	3	1.1075	0 - 4
	Team Size	1.2105	1	1.3693	0 - 4
	Team Tenure	2.1579	2	1.4053	0 - 4
V4 - Backlog Definition	Aptitude	3.6447	4	0.6262	1 - 4
	Experience	3.1447	3	0.9620	0 - 4
	Team Size	1.6316	1.5	1.4127	0 - 4
	Team Tenure	2.7105	3	1.1868	0 - 4

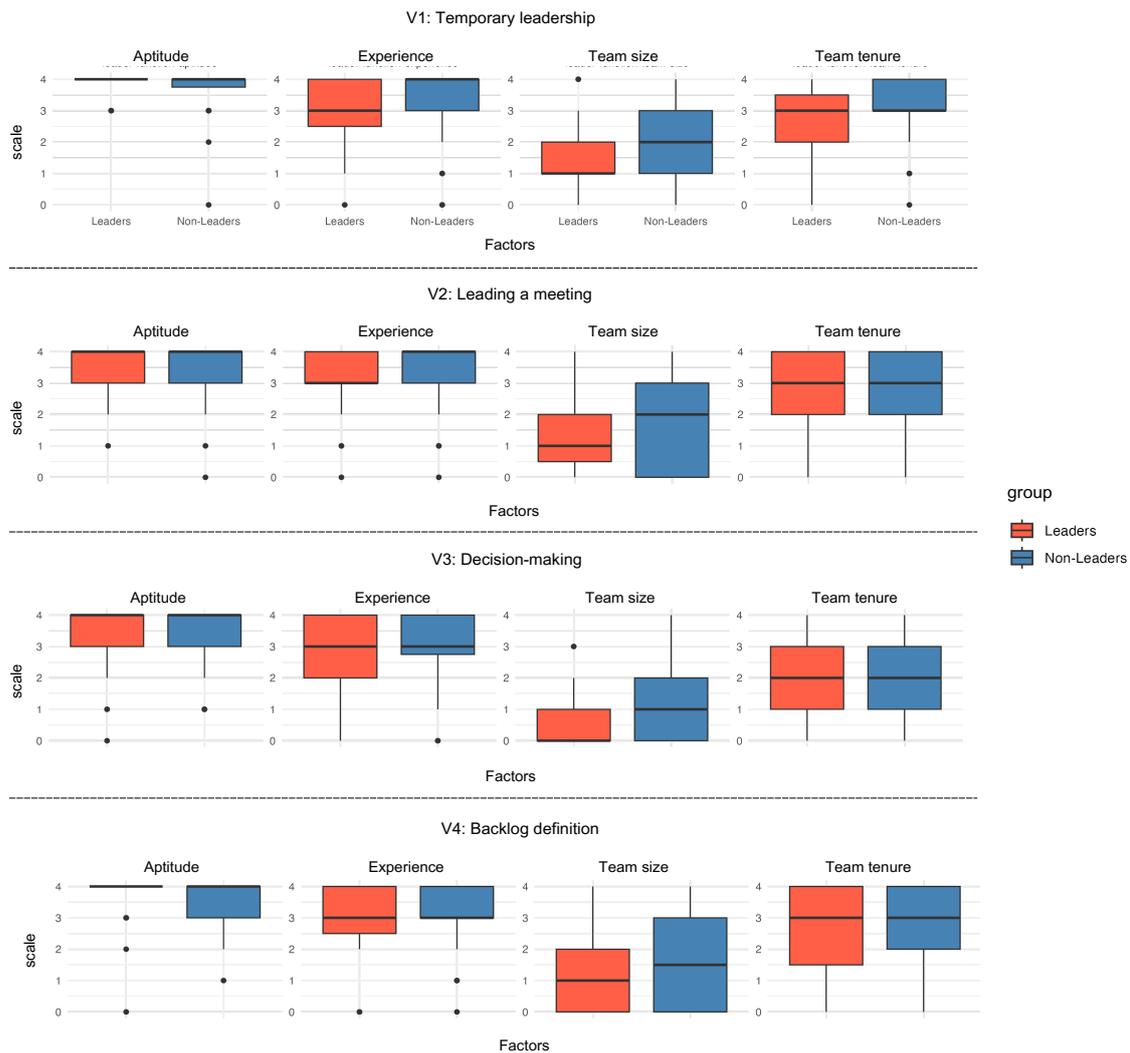
Descriptive analysis suggests that leaders and non-leaders value different factors when evaluating leadership scenarios. For leaders, **aptitude** was consistently the most important

factor across all vignettes, with means between **3.6** and **3.8**, suggesting that practical skills and immediate performance are important to leaders. **Experience** was also relevant, but with less weight, suggesting that leaders focus more on current ability than previous track records. On the other hand, time in the team and team size were perceived as less influential, especially the latter, with means generally below 1.5.

Non-leaders, although they also seem to consider **aptitude** the most important factor, attribute greater relevance to **experience** and **team tenure** than leaders. These factors presented means above **3.0** in several vignettes, especially in temporary leadership (V1) and backlog definition (V4). This difference suggests that non-leaders value track record and familiarity with the group more as criteria for the leader to attribute leadership.

Figure 4.3 shows the boxplots which complements the results of the previous tables. On the x-axis are the groups (leaders and non-leaders); on the y-axis is the score (Likert scale) on the factor's influence on the vignette in question.

Figure 4.3: Vignettes comparisons for leaders and non-leaders



The boxplots suggest some variability in the data (represented by the width of the boxplots), which appeared to be greater for non-leaders in several boxplots and the team size factor across all vignettes. We also note that the variability in responses was lower for leaders, suggesting greater consistency in their responses. Furthermore, for Vignette 2 (V2), it can be seen that this variability is similar across several factors (aptitude, experience, and team tenure), as are the median values for aptitude and team tenure.

To statistically confirm these differences, Mann-Whitney tests were conducted, and the results are summarized in Table 4.9, presenting the difference test (p-values) between leaders and non-leaders. In addition, Cohen's *d* values were calculated to interpret the effect size of the factors that showed statistically significant differences in the perceptions of leaders and non-leaders.

Table 4.9: Mann-Whitney tests: Comparing leaders and non-leaders across vignettes and leadership assignment factors.

Vignette	Factor	<i>p</i> -value	Cohen's <i>d</i> <i>d</i>
V1 - Temporary leadership	Team Tenure	0.049	0.47 (small)
	Experience	0.048	0.36 (small)
	Team Size	0.516	–
	Aptitude	0.335	–
V2 - Leading a meeting	Team Tenure	0.925	–
	Experience	0.138	–
	Team Size	0.513	–
	Aptitude	0.265	–
V3 - Decision-making	Team Tenure	0.388	–
	Experience	0.194	–
	Team Size	0.072	–
	Aptitude	0.976	–
V4 - Backlog definition	Team Tenure	0.984	–
	Experience	0.462	–
	Team Size	0.099	–
	Aptitude	0.367	–

**p*-value assuming $\alpha = 0.05$

According to the results in Table 4.9, each vignette and the attribution factors were evaluated:

Vignette 1: Temporary leadership:

Both factors **team tenure** (p-value **0.04998**) and **experience** (p-value **0.04847**) showed a statistically significant difference between the perceptions of leaders and non-leaders regarding the fact that the leader assigns their responsibilities to a non-leader over a certain period. Cohen's *d* value of **0.47** and **0.36**, respectively, represents a **small negative effect**, indicating that although the differences are statistically significant, the magnitude of these differences is relatively small. This suggests that leaders and non-leaders have different views on how tenure and experience influence the delegation of temporary leadership responsibilities. According to the descriptive data values presented in Tables 4.7 and 4.8, non-leaders perceive both factors as more important for their leaders to assign leadership activities than leaders themselves do, with a higher mean (3.0395 vs. 2.5714) and lower variability (sd of 0.9010 vs. 1.1704). This reflects that although leaders may also value these factors, they seem to prioritize, in this case, the non-leader's aptitude (mean = 3.8286; sd = 0.3824) as the decisive

factor for them to assign the temporary leadership role. On the other hand, team size (p-value 0.5161) and aptitude (p-value 0.3358) did not show statistically significant differences, implying that leaders and non-leaders share similar perceptions of these factors in the context of the leader assigning their responsibilities.

Vignette 2: Leading a Meeting:

None of the factors evaluated—team tenure (p-value: 0.9259), experience (p-value: 0.138), team size (p-value: 0.5135), and aptitude (p-value: 0.2655)—showed statistically significant differences between leaders and non-leaders. This indicates that their perceptions regarding the influence of these factors on assigning leadership responsibilities to non-leaders in the context of leading a meeting are similar. In this case, both groups seem to align in their views, suggesting a shared understanding of how these factors could play a role in the scenario. Although there were no statistically significant differences in the factors assessed for leadership in meetings, some nuances were observed. Leaders value aptitude more highly (mean score of 3.63) than non-leaders (mean score of 3.47), who believe they are valued for this factor. Non-leaders also believe they are valued more for their experience than leaders who may indeed value this factor (mean score of 3.32 versus 3.09 for leaders). Both groups have similar perceptions about team tenure (median of 3 for both) and consider team size to be the least relevant, although non-leaders attribute slightly greater importance to it (average of 1.58 versus 1.34 for leaders). These differences reflect subtle variations in the priorities of each group, even with an overall aligned vision.

Vignette 3: Decision-Making:

Like the previous vignette, no statistically significant differences were found for the factors team tenure (p-value: 0.388), experience (p-value: 0.1949), team size (p-value: 0.07294), or aptitude (p-value: 0.9768) in the context of assigning decision-making activities to non-leaders. These results suggest that leaders and non-leaders have similar perceptions of the relevance of these factors when delegating decision-making responsibilities. The lack of significant differences implies a consensus between the groups in this scenario. Although no statistically significant differences were found in the factors assessed for delegating decision-making activities, as for V2, the absolute values highlight some trends. Leaders attribute less importance to experience (mean of 2.71) and team tenure (mean of 1.91) compared to non-leaders (means of 3.00 and 2.16, respectively). On the other hand, both groups consider

aptitude the most relevant factor, with similar means (3.37 for leaders and 3.41 for non-leaders) and identical medians (4). Team size is the least valued by both groups, although non-leaders consider it slightly more relevant (mean of 1.21 versus 0.66 for leaders). These absolute differences suggest variations in individual perception despite a consensus among the groups.

Vignette 4: Backlog Definition:

Similarly, the factors of team tenure (p-value: 0.9842), experience (p-value: 0.4623), team size (p-value: 0.09933), and aptitude (p-value: 0.367) did not show statistically significant differences in the context of leaders assigning activities related to backlog definition to non-leaders. This suggests that leaders and non-leaders have aligned views on these factors, with no substantial divergence in their perceptions regarding their importance or influence in this scenario. Despite the absence of statistically significant differences in the factors assessed for delegating activities related to the backlog definition, the absolute values reveal some interesting variations. Both groups consider aptitude the most important factor, with similar averages (3.69 for leaders and 3.64 for non-leaders) and equal medians (4), indicating strong alignment. Team size was the least valued by both, although non-leaders presented a slightly higher average (1.63 versus 1.14 for leaders). Regarding experience and team tenure, the averages are similar between the groups, suggesting an aligned perception regarding the influence of these factors in this context.

Overall, the analysis of the four vignettes reveals that significant differences between leaders and non-leaders were only observed in **Vignette 1** (assuming the leader's full role), specifically for the factors of **team tenure** and non-leader **experience**, with small negative effect sizes. These differences indicate different perceptions regarding the influence of these factors on leadership delegation. On the other hand, no significant differences were identified in Vignettes 2 (leading a meeting), 3 (decision making) and 4 (defining the backlog) in any of the factors assessed, suggesting that leaders and non-leaders share similar views on the relevance of tenure, experience, team size and aptitude in these scenarios, although descriptive analyses reveal trends in the perceptions of each group: leaders attributed greater importance to aptitude and non-leaders demonstrated a slightly higher value for experience and time in the team. This highlights a mix of divergence and convergence in their perspectives on the attribution of leadership.

4.3.5 Summarizing the answer to the RQs

RQ3: What is the relationship between factors for assigning of leadership activities and leadership style perceived by leaders and non-leaders?

The analysis revealed that the relationship between leadership styles and factors for assigning leadership activities differs between leaders and non-leaders. For leaders, the correlations between leadership styles (TFL, TSL, and PAVL) and attribution factors (team tenure, experience, team size, and aptitude) were weak and non-significant, suggesting that these factors may have limited influence on their assignment decisions. On the other hand, non-leaders showed positive and significant correlations of their perceptions of TFL and TSL styles with the factors “team tenure,” “experience,” and “team size, suggesting that these factors may play a significant role in how their leaders assign leadership activities. PAVL style, in turn, did not show a significant correlation with any factor for either group, highlighting a limitation in this regard. These findings suggest distinct perspectives between leaders and non-leaders regarding the influence of leadership styles on the assignment of leadership activities.

So the null hypothesis (H_0) was partially rejected for non-leaders, as significant correlations were found between specific leadership styles and factors for assigning leadership activities, supporting the alternative hypothesis (H_1) for this group. However, the H_0 could not be rejected for leaders, suggesting that these factors may less influence their leadership style decisions.

RQ4: Are there differences between leaders’ and non-leaders perceptions of factors for assigning certain leadership activities?

The differences between leaders’ and non-leaders perceptions of the factors that influence the assignment of certain leadership activities were observed primarily in Vignette 1 (assuming the full leader role), where the “team tenure” and “experience” factors showed statistically significant differences with small negative effect sizes. These findings suggest that leaders and non-leaders perceive the influence of these factors differently when delegating leadership responsibilities. This result supports the alternative hypothesis (H_1) for this specific scenario, as the distributions between the groups were found to differ.

In contrast, no significant differences were identified in Vignettes 2 (leading a meeting), 3 (decision making), and 4 (defining the backlog) for any of the factors assessed (team tenure, experience, team size, and aptitude), indicating a consensus across groups in these scenarios. This suggests that leaders and non-leaders largely align in their views of the factors that influence specific leadership activities, with divergence observed only in the context of the entire leadership assignment. This supports the null hypothesis (H_0) in these scenarios.

4.4 Discussion of the results

4.4.1 Overview of Leadership Styles in Agile Teams

The classification of leadership styles based on the FRLM (Figure 4.2) revealed expected patterns based on previous studies that assess the perception of leaders only in agile software development teams, with a predominance of the TFL style (BASS; AVOLIO, 1996; MODI; STRODE, 2020; ARAÚJO et al., 2022). This style was identified by 60% of leaders and perceived by 65.8% of non-leaders. This convergence suggests a shared appreciation for the inspirational and motivational qualities of TFL, which are essential for fostering collaboration, innovation, and adaptability in agile teams (MOE; DINGSØYR; DYBÅ, 2010).

On the other hand, the TSL style, which emphasizes reward and goal-oriented practices, showed a disparity: 25.7% of leaders identified with this style, while only 9.2% of non-leaders perceived it. This discrepancy may reflect agile's emphasis on intrinsic motivators (for non-leaders) rather than extrinsic ones, as addressed by Ryan and Deci (2000) in their Self-Determination theory (RYAN; DECI, 2000). While TFL focuses on factors that foster intrinsic motivation, such as vision, values, and inspiration, TSL focuses on factors that promote extrinsic motivation, such as contingent rewards and management by exception (BASS; AVOLIO, 1996; RYAN; DECI, 2000). The results seem to indicate that non-leaders in agile contexts notice transactional practices less than leaders, possibly due to the predominance of collaborative environments that prioritize intrinsic engagement and self-regulation (DYBÅ; DINGSØYR, 2008).

This perception suggests that, in agile environments, there may be a misalignment between the perception of non-leaders and the transactional behaviors often exhibited by lead-

ers. This may indicate the need to adapt leadership practices to align more closely with agile principles, which favor intrinsic motivational practices such as autonomy and a sense of shared purpose (RYAN; DECI, 2000; GREN; RALPH, 2022).

The PAVL style was more frequently perceived by non-leaders (10.5%) than reported by leaders (5.7%). In non-agile environments, this discrepancy may highlight challenges in leadership visibility or the perception of insufficient involvement of leaders in decision-making, potentially hindering more traditional workflows. However, in agile environments, PAVL should not always be synonymous with an absence of leadership or inefficiency (ARAÚJO et al., 2022; YANG, 2015). In these contexts, where self-organization and self-management are fundamental, elements associated with PAVL, such as less direct intervention, can foster autonomy and decentralized decision-making, and can be seen as a leadership strategy (NORTHOUSE, 2018; YANG, 2015), aligning with the principles of the Agile Manifesto (BECK et al., 2001). The key challenge lies in achieving balance: excessive passive leadership can lead to abandonment or lack of direction (NORTHOUSE, 2018). However, strategic non-intervention can empower teams while ensuring alignment with organizational goals.

Like the PAVL, the indeterminate classification (in Figure 4.2 - when the values of the leadership classifications were equal) was relatively uncommon, appearing in 8.6% of leaders and 3% of non-leaders. In any case, it is worth noting that leaders do not align themselves exclusively to a single style, but use a combination of behaviors to meet the needs of the context or the team (ARAÚJO et al., 2022). This suggests that leaders in agile development environments tend to adopt more perceptible styles, such as TFL, to promote autonomy and engagement, or TSL, to ensure clarity in expectations and goals (ARAÚJO et al., 2022). However, this result may suggest that leaders who adopt an indeterminate style may be in situations of continuous adaptation, necessary to deal with challenges and dynamic changes. Once again, Situational Leadership Theory (HERSEY; BLANCHARD; NATEMEYER, 1979) can come into play in this context, providing a flexible framework that recognizes that leadership effectiveness depends on the leader's ability to adjust his or her style according to the level of development and maturity of his or her team, converging towards one style or another (ARAÚJO; MASSONI; GREN, 2024).

In addition, it is important to highlight the link between FRLM and the leadership the-

ories addressed in the previous Chapter 3 (case study). Some studies emphasize the importance of flexibility on the part of the leader (ARAÚJO et al., 2022; GREN; RALPH, 2022; SHARIFHERAVI; SHAHIDI; MAHMOOD, 2010; BERNARD, 1999), who must adjust his/her leadership style according to the circumstances, whether in the level of maturity of the team (Situational Leadership), in the demands of the team and the project (FRLM), or the shared dynamics within the group (Dynamic Team Leadership). In addition, all three approaches recognize the interaction between leader and followers, seeking to optimize team performance, whether through motivation (FRLM), skill development (Situational Leadership), or mutual collaboration (Dynamic Team Leadership). In all cases, leadership is seen as a dynamic process focused on ensuring collective success and continuous adaptation to the needs of the team (GREN; RALPH, 2022).

4.4.2 Correlations between Leadership Styles and Attribution Factors in Agile Teams (RQ3)

The correlation analysis between leadership styles (TFL, TSL, PAVL) and attribution factors (time on team, experience, team size, and aptitude) revealed distinct patterns for leaders and non-leaders. From the leaders' perspective, as shown in Table 4.5, the correlations were weak and non-significant between leadership styles and attribution factors among leaders. In other words, the TFL, TSL, and PAVL styles showed no relevant relationships with time on the team, experience, team size, or aptitude. This lack of correlation suggests that leaders in agile environments may base leadership attribution on more immediate factors, such as the urgent needs of a sprint or the collective goals of the team (such as the need to adapt quickly to change or the pursuit of continuous innovation), rather than individual attributes, such as length of experience or aptitude, for example. This aligns with the flexible and responsive nature of agile methodologies, where leadership is often distributed and adjusted according to the project's demands rather than being rigidly assigned based on static characteristics of each team member (GREN; LINDMAN, 2020).

On the other hand, the perceptions of non-leaders offered a contrasting view, with significant correlations observed between leadership styles and attribution factors (Table 4.6): The TFL style showed strong positive correlations with time on the team ($\rho = 0.39$,

$p = 0.00016$), experience ($\rho = 0.27$, $p = 0.023$) and team size ($\rho = 0.26$, $p = 0.028$). This suggests that non-leaders tend to perceive transformational leaders as valuing these factors when they need to assign responsibilities. This pattern aligns with agile principles, in which mentoring and harnessing collective expertise is fundamental (GREN; LINDMAN, 2020). The TSL style also exhibited positive correlations with time on the team ($\rho = 0.44$, $p = 0.00010$), experience ($\rho = 0.31$, $p = 0.0115$), and team size ($\rho = 0.28$, $p = 0.0161$). This indicates that transactional leaders, as perceived by non-leaders, in agile settings also consider these factors, possibly when they need to achieve specific and tangible sprint goals. For the TFL and TSL styles, aptitude was not a significant factor in leadership attributions. This result contrasts with the perception of the leaders in the case study 3, who indicated aptitude as a strong factor in assigning responsibilities to their leaders (ARAÚJO; MASSONI; GREN, 2024).

As for the PAVL style, the correlations were generally weak and non-significant, indicating that this style has minimal influence on the assignment of leadership activities, especially when based on individual assignment factors, in agile development contexts of the participants. This suggests that passive leadership, characterized by an avoidant and reactive approach (BWALYA, 2023), may have a limited impact on decisions about who assumes leadership responsibilities.

4.4.3 Differences between Leaders and Non-Leaders (RQ4)

V1: Temporary leadership

As mentioned at the beginning of this chapter, V1 is perceived as an activity that requires more experience and in-depth knowledge about the functioning of the team and its collaboration time since the non-leader will fully take on the role of the leader in their absence for a certain period. This is where we see a significant difference between the perceptions of leaders and non-leaders about the entire leadership role for the factors of team time and experience. The results of the Mann-Whitney test indicated a p-value of 0.04998 for the team time factor and 0.04847 for the experience factor, both statistically significant considering $\alpha = 0.05$. The effect sizes (Cohen's d) were -0.4714 and -0.3606, respectively, classified as small but indicating a subtle divergence in perceptions of these factors.

In the context of agile teams, the role of Scrum Master or Product Owner being seen as one of shared leadership (GREN; RALPH, 2022), the experience, and time on the team seems to be important indicators for defining who can take on leadership responsibilities at different times in the project (ARAÚJO; MASSONI; GREN, 2024). The divergence in perceptions between leaders and non-leaders may suggest that for non-leaders, experience and time on the team are factors that indicate the ability to delegate leadership functions more effectively, which can be seen as an attempt to ensure greater consistency and continuity in the team's activities (ARAÚJO; MASSONI; GREN, 2024).

However, for leaders, these factors may be perceived differently, perhaps with a view that experience should not be the only criterion for defining who takes on leadership roles in an agile context, where other factors such as aptitude, for example, are more valued than experience alone (ARAÚJO; MASSONI; GREN, 2024). This perception suggests a discrepancy between the visions of leadership for leaders and non-leaders, where leadership in agile environments often fosters decentralization and distribution according to the team's needs (HERSEY; BLANCHARD; NATEMEYER, 1979; ARAÚJO; MASSONI; GREN, 2024).

V2, V3 and V4: Leading a Meeting, Decision-making, and Backlog Definition

On the other hand, in V2, V3 and V4, which address more collaborative and recurring activities in the work of agile teams, the lack of significant differences suggests that, in this context, leaders and non-leaders share a more common understanding of the competencies required for these tasks. In agile teams, these activities generally involve a collective effort and more collaborative decision-making.

For example, leading a meeting (such as a Daily Scrum) or making decisions related to the backlog are often assigned to a team member (whether with more experience, more time on the team, or aptitude), not necessarily to a formally appointed leader (ARAÚJO; MASSONI; GREN, 2024). This aligns with the agile principles of autonomy and self-organization (BECK et al., 2001). In this sense, the lack of significant differences between the groups suggests that, in an agile context, the delegation of these activities is not so much linked to the status of the appointed leader but rather to the knowledge of the task and the team's ability to collaborate. Both leaders and non-leaders probably recognize that these activities can be carried out by any team member who has the necessary knowledge or the appropriate role at

the time (ARAÚJO; MASSONI; GREN, 2024; GREN; RALPH, 2022).

4.4.4 Implications

For SE Academy

This chapter's findings significantly contribute to understanding leadership styles in agile software development teams, broadening the scope of existing literature. The results reinforce the importance of practices that promote collaboration and intrinsic motivation in agile contexts by identifying the predominance of the transformational leadership style (TFL) and the shared perception between leaders and non-leaders. In addition, analyzing discrepancies between perceived leadership styles, such as transactional (TSL) and passive/absent (PAVL), offers new insights into the complexities of leadership in self-managed teams. These contributions open up opportunities for future investigations into the relationship between leadership styles, attribution factors, and team effectiveness in agile environments, encouraging debates about situational leadership and adaptive practices in leadership training.

For SE Research

The patterns identified between leadership styles and attribution factors suggest new lines of inquiry into how leaders and non-leaders perceive leadership practices in dynamic software environments. For example, the correlations observed between the TFL style and factors such as time on the team and experience among non-leaders highlight the need to explore further how contextual and individual characteristics shape leadership perceptions. Furthermore, the absence of significant correlations between attribution factors and leadership styles from the perspective of leaders suggests that the software project's immediate needs may influence leadership's role in agile teams more than individual characteristics. These findings provide an empirical basis for longitudinal and comparative studies investigating the evolution of leadership practices in SE in different organizational contexts.

For SE Industry

The results of this chapter have important practical implications for SE organizations adopting agile methodologies. The predominance of the TFL style, perceived and reported, re-

inforces the relevance of leadership practices that inspire and motivate teams, promoting innovation and collaboration. However, the discrepancies in perceptions of the TSL style and the low influence of the PAVL style highlight the need to adapt leadership practices to the agile context, favoring intrinsic motivators and autonomy. In addition, identifying differences in the perceptions of leaders and non-leaders regarding factors such as time on the team and experience can guide training and development programs for leaders, helping to align expectations and practices. For SE organizations, these findings suggest that effective leaders should adopt flexible and situational approaches to maximize the performance and engagement of software agile teams.

4.5 Threats to Validity

4.5.1 Construct Validity

Applying the FRLM (Full-Range Leadership Model) to agile teams may be compromised due to the model's limitation in capturing the specific nuances of other leadership styles that may exist in these teams. Although the FRLM is widely used and valid, other styles can be used and adjusted to the dynamic needs of the teams in which the participants may be embedded. In addition, the emphasis on autonomy, transparency, and continuous learning in agile methodologies can give rise to leadership practices not fully addressed by the FRLM, limiting its ability to capture the complexity of leadership behavior in this context. Even so, what was considered was the similarity between the FRLM and the other leadership paradigms identified in the previous study (Situational Leadership and Dynamic Team Leadership), where both are centered on adaptability to the context and the needs of the team.

4.5.2 Internal Validity

Internal validity may be compromised by uncontrolled factors that affect leadership perceptions, such as organizational culture, the level of agile maturity of teams, or interpersonal relationships between team members. However, as mentioned in the methodology, we chose the factors and vignettes based on the results obtained in the previous study to assess and validate the findings. In addition, the lack of significant correlations between the attribution

factors and the leadership styles reported by leaders may be because the number of participants considered leaders was smaller than the number of non-leaders. On the other hand, since our primary focus is on non-leaders perception, the number of leaders for comparison was higher than we expected.

4.5.3 External Validity

The specificity of the context studied may limit external validity. The focus on agile development teams may make it difficult to generalize the results to other organizations or teams that use more traditional methodologies. On the other hand, it is observed that the current business environment requires companies to respond quickly to remain competitive, especially in software development, where agility and advances such as the integration of AI make traditional methods increasingly obsolete (INC., 2025; TOBISCH; SCHMIDT; MATTHES, 2024). In addition, the data were collected in Brazil, in a cultural context where perceptions of leadership can vary significantly in other parts of the world. On the other hand, the participants are part of several companies (many of which may be multinational) that use agile methods and support a workflow similar to other organizations around the world. Finally, the small number of participants in some categories of leadership styles, such as the PAVL style, may limit the applicability of the results to contexts in which this style is more prevalent or perceived differently. This also minimizes bias by knowing that many leaders can adapt different styles depending on the context and moment of the team.

Chapter 5

General Discussion

The results of this thesis highlight the complexity of leadership in agile software development teams, especially regarding the perspective of leaders and non-leaders with differences and similarities in their views on leadership practices in their teams, in addition to the interaction between leadership styles and responsibility assignment factors. Both studies presented here emphasize that leadership in these agile teams, in general, is not a linear process, but rather dynamic and contextual, influenced by factors such as experience, team tenure, team size, and individual aptitude for leaders and non-leaders to assume leadership activities in different contexts.

5.1 Convergence and Divergence in Leadership Perceptions

The studies identify similarities and differences in leadership perceptions between leaders and non-leaders. The first study (Chapter 3), of a qualitative nature, addresses leadership views between leaders and non-leaders, emphasizing the situational and dynamic nature of leadership in the perception of these professionals, with leaders adapting their styles based on team maturity and individual readiness, aligning with the theories of SLT and Dynamic Team Leadership (DTLT) (ARAÚJO; MASSONI; GREN, 2024). This adaptability is important in agile teams, where team composition and maturity can change fast as projects evolve (HERSEY; BLANCHARD; NATEMEYER, 1979). Thus, teams must recognize these

changes with the leader's help and adjust their approach to maintain alignment and performance.

The second study in Chapter 4, deepens this understanding by quantitatively assessing other leadership styles that relate to the leadership styles studied in the previous study, highlighting the prevalence of TFL among leaders and non-leaders, suggesting a shared appreciation for motivational and inspirational leadership traits that promote collaboration and innovation. In agile contexts, TFL focuses on vision, and team empowerment is well aligned with principles such as self-organization and collective ownership (GREN; RALPH, 2022). However, this second study also reveals a disparity in the perception of TSL. Non-leaders seem to identify intrinsic motivators, such as personal growth and recognition within the team, rather than extrinsic factors, such as rewards or task completion, as leaders seem to perceive. This divergence suggests that there may be potential gaps in how leaders implement TSL strategies. Future studies can investigate these differences and see how this may affect SE activities.

Another interesting finding is the perception of PAVL. While leaders may occasionally adopt a more passive approach to fostering autonomy, non-leaders often interpret this as lacking support or engagement, as Northouse (2018) suggests (NORTHOUSE, 2018). In agile contexts, where responsiveness and collaboration are crucial, such misinterpretations can lead to frustration and reduced team trust (YANG, 2015). This highlights the need for clarity of leadership intentions and consistent communication within teams to overcome differences in perceptions of leader passivity in order to foster greater team autonomy.

5.1.1 Leadership Assignment Factors

Chapter 4 complements Chapter 3 by revealing some factors for leadership attribution by leaders to non-leaders, namely team tenure, experience, team size, and aptitude. Such factors may be relevant in agile environments, where leadership is often distributed, and team members may assume leadership depending on the task or sprint objectives (GREN; RALPH, 2022). Based on our case study (Chapter 3), these factors may be valued so that leaders can assign leadership responsibilities to non-leaders, especially about transformational and transactional leadership styles. In turn, our survey study (Chapter 4) suggests that, for leaders, these factors may not be as crucial in their attribution decisions. For non-leaders, however,

these factors demonstrate particular importance for the attribution of responsibilities by their leaders, especially the factors of team tenure, experience, and team size. In this regard, evidence from the Chapter 3 study suggests that, in smaller teams, leadership tends to be more fluid and shared, while in larger teams, the presence of defined roles may require a more structured approach (ARAÚJO; MASSONI; GREN, 2024).

It is also worth noting that leaders and non-leaders perceive the influence of these factors differently when delegating temporary leadership responsibilities (V1). Future studies may further identify where these differences lie and where this may impact them. In contrast, a consensus was observed among them in more specific scenarios (V2, V3, and V4).

However, given these divergences, agile leaders must be aware of these dynamics, ensuring that their leadership style evolves with the size and complexity of the team (HERSEY; BLANCHARD; NATEMEYER, 1979). Fostering an environment where all team members feel empowered to contribute to leadership decisions can help mitigate potential tensions arising from different perceptions (GREN; RALPH, 2022). Furthermore, introducing a leadership plan at different stages of the team's development and evolution process with the entire team can be effective in mitigating differences of opinion about what role of responsibility each member can assume individually and collectively at different moments of the development process.

5.2 The Role of Leadership Styles in Agile SE Contexts

The adaptability of leadership styles is a recurring theme, particularly in how leaders balance transformational, transactional, passive, situational, and dynamic approaches (ARAÚJO; MASSONI; GREN, 2024; ARAÚJO et al., 2022; SHARIFHERAVI; SHAHIDI; MAHMOOD, 2010; MODI; STRODE, 2020). The study presented in Chapter 3 highlights the situational and dynamic nature of leadership sharing, where non-leaders perceive the importance of their individual role in their leaders. In contrast, their leaders seek to promote dynamism and, consequently, adaptability and distribution of their leadership to the team, as seen in (GREN; RALPH, 2022). These results also align with other studies in agile; for example, in ceremonies such as retrospectives and sprint planning, roles and responsibilities are frequently shared and reassessed to meet the project's evolving needs from the leader's

perspective (MOE; DINGSØYR; DYBÅ, 2010; COHN, 2000; GREN; LINDMAN, 2020). However, this thesis presents the view of non-leaders, who present similarities but also divergences in the perceptions of leadership already reported by leaders in the cited works.

In the second study (Chapter 4), the adaptability of leadership styles also highlights how leaders predominantly use the TFL style to inspire and align their teams but also resort to transactional elements to ensure accountability and progress (AVOLIO; BASS; JUNG, 1999). In agile contexts, this adaptability is recurrent: while transformational practices drive innovation and engagement (GHASABEH; SOOSAY; REAICHE, 2015), transactional practices provide the structure and clarity needed to achieve short-term goals (BASS; AVOLIO, 1996; ARAÚJO et al., 2022).

Both studies also highlight the role of leadership styles in managing conflict and promoting psychological safety and a sense of belonging within agile teams. Leaders who effectively balance directive (TSL) and supportive (TFL) behaviors can create environments where team members feel comfortable taking risks and sharing ideas, as they are empowered by the sense of belonging that such styles can promote, which is important for the software development process (GREN; RALPH, 2022). On the other hand, misalignment in leadership approaches can stifle creativity and lead to disengagement, especially in teams where autonomy is highly valued (YANG, 2015). Thus, leaders and non-leaders must know the team they are part of well, and the leader, as a key role in the team, must adopt a guiding stance, adjusting his/her leadership style to the specific needs and characteristics of the team and the project context, maintaining constant communication about the dynamism of leadership.

5.3 General Implications and Contributions

This thesis offers practical implications relevant to leadership in agile software development teams, contributing to a more robust understanding of how leadership styles and practices can be applied to improve team dynamics and performance. The findings highlight the need for agile leaders to adopt flexible and situational approaches, adjusting their styles to the specific demands of their teams and projects while fostering a culture of collaboration and innovation.

First, the practical implications reinforce the importance of leaders investing in interpersonal and emotional skills to foster environments of psychological safety, essential for success in agile teams (GREN; RALPH, 2022). Transformational practices, which prioritize inspiration, motivation, and support for individual growth, are especially effective in aligning the team with organizational goals and promoting autonomy, a central tenet of agile methodologies (JAKOBSSON; SAMIMIAN, 2023; BASS; RIGGIO, 2006). Furthermore, the need for leaders to understand and address discrepancies between their intentions and the perceptions of the team (non-leaders) points to the value of continuous feedback and adaptation practices.

Another important practical suggestion is the role of specific training in agile leadership for all team members. Training that combines principles of agile methodologies with situational and TFL tools can prepare leaders and team members to deal with these contexts' complex and often uncertain dynamics. In addition, the research highlights the potential for organizations to explore shared leadership models, empowering team members not designated as leaders to assume leadership roles in a flexible and situational manner to foster resilience and innovation in projects.

In the theoretical field, the main contribution is to present the view of non-leaders on leadership through quantitative and qualitative studies, opening doors for future research to deepen the understanding of how leadership is practiced and where differences between leaders and non-leaders can impact the practice of software development. Furthermore, the study contributes by reinforcing the applicability of classical theories, such as SLT and TFL, to agile team contexts, integrating them with the principles of agile methodologies. This integration offers a perspective to explore leadership as a dynamic and interactive process rather than a static role.

Finally, and as already mentioned, the work offers several subsidies for future research. Additional investigations could explore how different leadership views in the team can impact development activity practices, such as code review, deployment, productivity, among others. It is also possible to replicate this research for more diverse samples, such as from other cultures. Future work could also assess how different combinations of leadership styles influence effectiveness in agile development teams of different sizes, maturity, or complexity. In addition, studies could focus on strategies to reduce gaps between leaders and non-

leaders, identified as a critical point for aligning expectations and improving team performance (ARAÚJO; MASSONI; GREN, 2024). By linking theoretical aspects to the practical needs of agile teams, the contributions of this thesis offer a promising path to strengthen leadership in these environments and, consequently, the success of software projects.

5.3.1 Practical Implications for Agile Software Development Teams

- a) **Promotion of shared leadership:** Agile software development teams should foster a culture where all members can take on leadership roles situationally, regardless of formal titles, contributing to resilience, innovation, and adaptability in fast-changing project environments.
- b) **Attention to team maturity and experience:** Teams should recognize that collective maturity, team size, and time spent working together influence leadership dynamics and team effectiveness. Encouraging knowledge sharing between experienced and less experienced members can strengthen collaboration and decision-making.
- c) **Continuous feedback culture:** Agile software teams should adopt regular feedback mechanisms (such as retrospectives, one-on-one meetings, etc.) to ensure alignment between the intentions of the leaders and the perceptions of the team members, reducing miscommunication and improving team cohesion.
- d) **Fostering autonomy and intrinsic motivation:** Teams should strive to cultivate environments that promote psychological safety, inspiration, and autonomy, supporting transformational practices that drive innovation, proactivity, and individual accountability.
- e) **Openness to multiple perspectives:** Including the viewpoints of non-leader team members in technical decisions, sprint planning, conflict resolution, and scope changes should become part of the team's routine, reinforcing leadership as a collective and dynamic property rather than a static role.

5.3.2 Practical Implications for Managers of Agile Software Development Teams

- a) **Adaptation of leadership style:** Managers should adopt situational leadership approaches, adjusting their style according to the maturity, experience, and size of the team. This flexibility is crucial to effectively lead diverse and evolving agile teams.
- b) **Continuous development of soft skills:** Managers must invest in developing emotional intelligence and interpersonal skills to foster psychologically safe environments that encourage open communication, trust, and team growth.
- c) **Incorporation of transformational practices:** Inspiring, motivating, and supporting the professional development of team members should be part of daily leadership practices, aligning with agile values that emphasize autonomy, collaboration, and continuous improvement.
- d) **Monitoring and aligning perceptions:** Managers must proactively identify and address the gaps between their leadership intentions and how the team perceives their actions. Regular feedback loops and team health checks can help maintain alignment and trust.
- e) **Structured and ongoing leadership training:** Beyond technical expertise, managers should engage in continuous training that integrates agile principles with situational (SLT) and transformational (TFL) leadership tools, preparing them to navigate complex and dynamic project environments.
- f) **Encouraging distributed leadership models:** Managers should create opportunities for team members to assume leadership roles in specific contexts, promoting adaptability, ownership and innovation.

Chapter 6

Related Work

The study of leadership perceptions and differences between leaders and non-leaders is relatively well-researched in the management literature. However, in SE, few studies focus on the figure of non-leaders. The following studies were selected either because they are embedded in the context of leadership in SE or because they similarly emphasize non-leaders' context. Both emphasize how interpersonal skills, life experiences, and specific contexts influence leadership behavior and effectiveness. This section reviews the main related studies that support and contextualize this thesis.

6.1 “*What Makes Effective Leadership in Agile Software Development Teams?*” by Lucas Gren and Paul Ralph - 2022.

The main one is the article “*What Makes Effective Leadership in Agile Software Development Teams?*” by (GREN; RALPH, 2022), which examines leadership in agile software development teams from the perspective of leaders, being the starting point for the elaboration of this thesis. It presents the main factors that, for leaders, make leadership effective in an agile context, highlighting that leadership in agile teams is: (i) dynamically shared among team members (it is not a fixed role, but a distributed and adaptable work to the circumstances); (ii) it promotes a sense of belonging (where the team needs to identify with the team and accept responsibilities), and; (iii) it balances conflicting organizational cultures (where agile

leaders often need to manage tensions between agile culture and traditional organizational practices).

The study was based on interviews with 13 professionals who identify as agile leaders representing various industries and countries. The results indicate that agile leadership requires skills to (i) enable team members to take responsibility and lead, (ii) build a strong social identity in the team, and; adapt to different organizational cultures. The article highlights the relevance of integrating social psychology and organizational identity theories into research on agile leadership, proposing that leadership should be seen as a shared work rather than a fixed role.

Table 6.1 presents the differences and similarities between the work of Gren and Ralph (2022) and the studies that make up this thesis.

Table 6.1: Comparison between Gren and Ralph (2022) and this Thesis

Aspect Compared	Study by Gren and Ralph (2022)	This Thesis	Similarities/ Differences
Main objective	Examines the nature of leadership in agile teams.	Analyzes leadership views between leaders and non-leaders.	Both investigate leadership but with different focuses.
Study context	Agile software development teams.	Agile software development teams.	Both in agile software development teams.
Data collection method	Qualitative interviews with 13 agile leaders.	Qualitative interviews and quantitative analysis with a survey.	This thesis: more than one study.
Leadership factors investigated	Leadership sharing, social identity, organizational culture.	Views on agile leadership between leaders vs. non-leaders; Team tenure, aptitude, team size, experience for leadership assignment.	Complementary: the article focuses on cultural aspects; the thesis on individual characteristics.
Findings on leadership	Leadership is shared and adaptable.	Differences in leadership perceptions between groups.	Both highlight leadership as dynamic.
Focus on organizational culture	Central: managing tensions between agile and traditional cultures.	Less emphasis; focus on individual characteristics.	Divergence in the importance given to culture.

6.2 “Leadership-shaping Experiences: a Comparative Study of Leaders and Non-leaders” by Amit et al. - 2009.

Another interesting study on the difference between leaders and non-leaders is the article “Leadership-shaping experiences: a comparative study of leaders and non-leaders” by (AMIT et al., 2009). In it, the authors explore how life experiences impact the development of leaders, comparing soldiers identified as leaders and non-leaders. The study was conducted with soldiers from the Israeli army, divided into leaders (50) and non-leaders (30), and assessed through quantitative questionnaires and qualitative interviews. The results showed that leaders had greater exposure to leadership experiences in their youth, such as taking on school responsibilities and participating in social organizations. These experiences not only strengthened leadership self-efficacy but also developed influencing and situational leadership skills. In addition, the study highlights the importance of reflective processes on past experiences as a learning tool.

Table 6.2 presents the differences and similarities between the work of Amit et al. (2009) and the studies that make up this thesis.

6.3 “A Comparative Study between the Views of Leaders and Followers on the Importance of Soft Skills in Software Development” Coelho et al. - 2024 - in Portuguese

Recently, the article “A Comparative Study between the Vision of Leaders and Led on the Importance of Soft Skills in Software Development” by (COELHO et al., 2024) - in Portuguese, explores the perception of leaders and non-leaders on the importance of soft skills in the context of software development. Conducted in one of the largest technology centers in Brazil, the study included 42 professionals who responded to a survey. Each group’s soft skills, considered most important, were analyzed, revealing convergences and divergences in their views. The results showed that, for leaders, the most valued skills include communication, commitment, responsibility, teamwork, and motivation. On the other hand, non-leaders highlighted teamwork, commitment, responsibility, communication, and willingness to learn.

Table 6.2: Comparison between Amit et al. (2009) and this Thesis

Aspect Compared	Study by Amit et al. (2009)	This Thesis	Similarities/ Differences
Main Objective	Explore how life experiences shape leaders.	Analyze differences in perception between leaders and non-leaders.	Both investigate leadership formation or perception, but with distinct focuses.
Studied Population	Israeli army soldiers (male).	Leaders and non-leaders in software projects (diverse genders).	Different contexts and samples (military vs. organizational).
Methodology	Questionnaires and qualitative interviews.	Qualitative interviews and Statistical tests.	Differences in analytical approaches and data collection methods.
Focus on Experiences	Emphasis on past experiences (youth, family, school).	Exploration of factors such as aptitude, team tenure, and professional experience.	Both analyze leadership influences but in different life stages.
Main Results	Leaders had more formative experiences in youth.	Leaders and non-leaders differ in perception of leadership factors and skills.	Both highlight clear differences between the two analyzed groups.
Practical Implications	Suggestions for training based on reflection.	Insights for team formation and leadership development.	Both propose practical applications to improve organizational processes.

The perceptions indicate that, although there is consensus on several skills, there are subtle differences in the priority given to some, such as motivation and organizational skills. The research concludes that developing soft skills is essential for the success of software projects, suggesting that leaders and team members can use the results to improve their skills and team building.

Table 6.3 presents the similarities and differences between the work of Coelho et al. (2024) and this thesis.

Table 6.3: Comparison between Coelho et al. (2024) and this Thesis

Aspect Compared	Study by Coelho et al. (2024)	This Thesis	Similarities/ Differences
Main objective	Explores perceptions of the importance of soft skills among leaders and non-leaders in software development.	Analyzes differences in leadership perception between leaders and non-leaders in agile leadership and leadership assignment factors.	Both explore differences between leaders and non-leaders, but with different emphases.
Study population	Leaders and non-leaders in a technology center in Brazil.	Leaders and non-leaders in software development teams in Brazil, but in a broader context.	Both analyze similar groups, but the thesis has a more diverse sample context.
Methodology	Survey with 42 participants, descriptive analysis, and heatmaps.	Interviews with qualitative analysis and quantitative statistical tests.	Methodological differences.
Soft skills investigated	Communication, teamwork, commitment, responsibility, and motivation.	No specific focus on soft skills, but on contextual factors and leadership perception.	Coelho et al. focus specifically on soft skills, while the thesis examines broader leadership perceptions.
Main findings	Leaders prioritize communication and motivation; non-leaders highlight willingness to learn and teamwork.	Leaders and non-leaders differ in their leadership perception based on factors such as time and aptitude.	Both highlight differences between groups, with complementary approaches.
Practical implications	Suggestions for aligning interpersonal skills with the demands of each role in software projects.	Insights to improve leadership task assignment and leadership development in projects.	Both provide practical recommendations, but with different focuses (soft skills vs. leadership).

6.4 “Self-leadership practices and beliefs in nonprofit organizations: differences between leaders and non-leaders” by Dunaetz et al. - 2024

The article “Self-leadership practices and beliefs in Nonprofit organizations: Differences between leaders and Non-leaders” by (DUNAETZ et al., 2024) investigates the differences in self-leadership practices and beliefs about their importance between leaders and non-leaders

in nonprofit organizations. Based on an online survey with 318 participants (254 leaders and 64 non-leaders), the research assesses nine self-leadership practices, highlighting how leaders engage more in self-setting goals and self-observation compared to non-leaders, who, on the other hand, use more self-reward and self-punishment. Furthermore, beliefs about the importance of these practices followed similar patterns, with leaders attributing more significant value to self-setting goals and self-observation.

The study reveals that not all self-leadership practices are equally effective in the context of leadership. Although self-leadership is associated with effective leaders, practices such as self-punishment and self-reward are not useful for leader development. The practices of self-goal setting and self-observation, in turn, emerge as important components that could be incorporated into leadership training programs.

Table 6.4 presents the similarities and differences of the work of Dunaetz et al. (2024) with this thesis.

Table 6.4: Comparison between Dunaetz et al. (2024) and this Thesis

Aspect Compared	Study by Dunaetz et al. (2024)	This Thesis	Similarities/ Differences
Main Objective	Examines differences in self-leadership practices and beliefs between leaders and non-leaders in nonprofits.	Analyzes differences in leadership perceptions between leaders and non-leaders in software development teams.	Both study differences between leaders and non-leaders but with distinct focuses.
Study Context	Nonprofit organizations.	Software development teams.	Differ in context: nonprofits vs. software development.
Data Collection Method	Online survey with 318 participants (leaders and non-leaders).	Vignettes and questionnaires with leaders and non-leaders.	Both use quantitative methods, but with different approaches.
Factors Investigated	Nine self-leadership practices (e.g., goal-setting, self-observation).	Experience, team tenure, aptitude, and team size in leadership assignments.	Complementary: the article focuses on individual practices; this thesis on group and contextual factors in software engineering.
Findings on Leadership	Leaders excel in goal-setting and self-observation, while non-leaders engage more in self-reward and self-punishment.	Leaders and non-leaders have distinct perceptions of factors influencing leadership.	Both identify significant differences between the groups.
Cultural Relevance	Highlights the role of organizational values in nonprofits.	Does not directly explore cultural aspects.	Divergence in focus on culture.
Practical Applications	Suggests focusing on specific practices (e.g., goal-setting) in leadership training.	Points out how differences in perceptions impact team dynamics.	Both provide insights for leadership development.

In summary, the studies presented in this section provide a comprehensive overview of the differences between leaders and non-leaders, highlighting the importance of leadership practices, life experiences, and soft skills in team development, especially in Software Engineering. In this way, these studies offer insights that allow us to understand how different factors influence leadership and can be applied to the context of software development, serving as a basis for the analysis presented in this thesis.

Chapter 7

Conclusions and Future Work

This thesis sought to investigate, in greater depth, the differences and similarities in the perceptions of leadership between leaders and non-leaders in software development teams. Two studies were necessary to answer the research questions that arose in light of the problems found in the literature, where research on the perspective of non-leaders on leadership is scarce, as well as in practice, where it is clear that there is no consensus on the attributions and duties of agile leadership for non-leaders who occasionally perform leadership activities. These activities demand responsibilities and important decision-making that affect the development process, given the intrinsically human nature of this activity (GREN; RALPH, 2022).

The first study, of a qualitative nature (Chapter 3), arose from the need to fill a gap in research related to leadership in software development teams, especially in teams that follow agile approaches and emphasize self-management. The case study results highlighted differences and similarities in the perception of leadership between developers who explicitly do not consider themselves leaders and those who are considered leaders. Factors such as the experience of non-leaders, their tenure in the team, the aptitude of non-leaders as perceived by leaders, and the size of the team were decisive in identifying the leadership theories perceived by these professionals.

In the smaller team, with more experienced non-leaders and perceived leadership skills, the leader tends to see leadership as situational, distributing leadership activities dynamically. In contrast, these non-leaders perceive this dynamic form more strongly while still seeing the role of the individual leader. In the larger team, with experienced and less experienced non-

leaders, the leader tends to see leadership more dynamically, and most non-leaders perceive leadership in a situational way.

In general, the non-leaders studied in Caption 1.5 tend to see leadership as a function assigned to a single person responsible for delegating, guiding, and responding to the team. On the other hand, the leaders studied see agile leadership as a responsibility shared by the entire team, emphasizing the team's involvement in decision-making and corroborating previous research (GREN; RALPH, 2022).

The second study, of a quantitative nature (Chapter 4), investigated the differences and similarities in the perceptions of leadership between leaders and non-leaders in software development teams, considering factors such as experience, time in the team, aptitude, and team size identified in the previous study. Based on the results obtained, it was evident that the perceptions of leadership vary significantly between the groups analyzed, generating relevant impacts on the dynamics of the teams and, consequently, on the software development process.

Thus, the study's contributions involve two studies with a related article published so far (ARAÚJO; MASSONI; GREN, 2024) with a replication package available in Appendix A, containing documents and validated analyses. The results of this thesis contribute to a deeper understanding of leadership dynamics in software development teams. By integrating distinct perceptions of leaders and non-leaders, the work reveals that more inclusive and adaptive leadership practices can be suggested to promote better communication, more meaningful alignment, and performance in teams. Furthermore, it highlights the need to align expectations in agile contexts, where leadership is often seen as dynamic and shared.

7.1 Ideas for Future Work

Although this study has advanced the understanding of leadership perceptions, some questions remain open and offer opportunities for future research. A replication using demographic data could observe how leaders and non-leaders in different roles or experience levels may differ in their perceptions. In addition, it would be possible to investigate how team size (smaller or larger teams) may affect leadership perspectives. Another investigation could look more deeply at the impact of the results of this thesis on specific Software

Engineering activities, such as code review, software quality, and evolution, for example. Furthermore, analyzing the impact of different agile methodologies could help explore how work approaches, such as Scrum, Kanban, Lean, and TDD, shape leadership perceptions.

Another relevant aspect would be to examine cultural and organizational factors from the perspective of non-leaders, which could reveal how these factors affect leadership views and their impact on team and Software Engineering performance. Finally, research on perceptions in multidisciplinary teams also represents a promising line of research, considering how perceptions of leadership vary in teams composed of professionals from different areas and levels of experience.

7.2 Final Considerations

The findings of this thesis reinforce the importance of considering multiple perspectives when investigating leadership in software development teams. By highlighting significant differences between leaders and non-leaders, this work provides a solid basis for interventions that promote more effective and inclusive leadership practices. It is hoped that these contributions will inspire new studies and help build more aligned, collaborative, and resilient teams in the technology sector.

Bibliography

- AL-HAMEED, K. A. A. Spearman's correlation coefficient in statistical analysis. *International Journal of Nonlinear Analysis and Applications*, Semnan University, v. 13, n. 1, p. 3249–3255, 2022.
- AMIT, K.; POPPER, M.; GAL, R.; MAMANE-LEVY, T.; LISAK, A. Leadership-shaping experiences: a comparative study of leaders and non-leaders. *Leadership & Organization Development Journal*, Emerald Group Publishing Limited, v. 30, n. 4, p. 302–318, 2009.
- ARAÚJO, N.; MASSONI, T.; GREN, L. Views on agile leadership for software teams: A case study with leaders and non-leaders. In: *Proceedings of the 38th Brazilian Symposium on Software Engineering, SBES 2024, Curitiba, Brazil, September 30 - October 4, 2024*. [s.n.], 2024. p. 126–135. Disponível em: <https://doi.org/10.5753/sbes.2024.3324>.
- ARAÚJO, N.; MASSONI, T.; SARMENTO, C.; SANTOS, F.; OLIVEIRA, R. Investigating the relationship between software team leadership styles and turnover intention. In: *Proceedings of the XXXVI Brazilian Symposium on Software Engineering*. [S.l.: s.n.], 2022. p. 106–111.
- ASTELS, D. *Test driven development: A practical guide*. [S.l.]: Prentice Hall Professional Technical Reference, 2003.
- AVOLIO, B. J.; BASS, B. M.; JUNG, D. I. Re-examining the components of transformational and transactional leadership using the multifactor leadership. *Journal of occupational and organizational psychology*, Wiley Online Library, v. 72, n. 4, p. 441–462, 1999.
- BALTES, S.; RALPH, P. Sampling in software engineering research: A critical review and guidelines. *Empirical Software Engineering*, Springer, v. 27, n. 4, p. 94, 2022.
- BARFOD, J. R.; CLIFTON, J. Is transformational military leadership out there? an exploratory research study of military teams in action. *Armed Forces & Society*, SAGE Publications Sage CA: Los Angeles, CA, p. 0095327X241309327, 2025.
- BASS, B. M. *Leadership and performance beyond expectations*. [S.l.]: Free press New York, 1985.
- BASS, B. M.; AVOLIO, B. J. Multifactor leadership questionnaire-short form 6s. *Binghamton, NY: Center for Leadership Studies*, 1992.
- BASS, B. M.; AVOLIO, B. J. Multifactor leadership questionnaire. *Western Journal of Nursing Research*, 1996.

- BASS, B. M.; RIGGIO, R. E. Transformational leadership. Psychology press, 2006.
- BASSANI, E. V. T.; VIEGAS, S. C. Liderança situacional e seus impactos para as organizações. In: *REFAQI-REVISTA DE GESTÃO EDUCAÇÃO EE TECNOLOGIA*. [s.n.], 2021. v. 9, p. 11–11. Disponível em: [〈https://refaqi.faqi.edu.br/index.php/refaqi/issue/view/15〉](https://refaqi.faqi.edu.br/index.php/refaqi/issue/view/15).
- BATISTA, A. C. D. Qualidade do trabalho em equipe no desenvolvimento de software: uma abordagem multimétodo. Universidade Federal de Pernambuco - In portuguese, 2021.
- BECK, K.; BEEDLE, M.; BENNEKUM, A. van; COCKBURN, A. *Agile Software Development Manifesto*. Ward Cunningham, 2001. (Accessed on 06/21/2023). Disponível em: [〈https://agilemanifesto.org/iso/ptbr/manifesto.html〉](https://agilemanifesto.org/iso/ptbr/manifesto.html).
- BECKER, L. A. *Effect size (ES)*. [S.l.]: Colorado Springs, 2000. Available <https://www.uv.es/friasnav/EffectSizeBecker.pdf>.
- BELL, J. T. Extreme programming. *Thinking for Innovation*, p. 1–19, 2001.
- BENMIRA, S.; AGBOOLA, M. Evolution of leadership theory. *BMJ leader*, BMJ Specialist Journals, p. leader–2020, 2021.
- BERNARD, M. B. *Hand Book of Leadership: theory, research, and managerial applications*. [S.l.]: Collier Macmillan Publisher., 1999.
- BOLDEN, R. Distributed leadership in organizations: A review of theory and research. *International journal of management reviews*, Wiley Online Library, v. 13, n. 3, p. 251–269, 2011.
- BOSSE, T.; DUELL, R.; MEMON, Z. A.; TREUR, J.; WAL, C. N. van der. Computational model-based design of leadership support based on situational leadership theory. *Simulation*, SAGE Publications Sage UK: London, England, v. 93, n. 7, p. 605–617, 2017.
- BRAUN, V.; CLARKE, V. Using thematic analysis in psychology. *Qualitative research in psychology*, Taylor & Francis, v. 3, n. 2, p. 77–101, 2006.
- BROOKES, S. *The selfless leader: a compass for collective leadership*. [S.l.]: Bloomsbury Publishing, 2017.
- BWALYA, A. Leadership styles. *Global Scientific Journal*, v. 11, n. 8, 2023.
- COELHO, M.; ARAÚJO, A.; FREIRE, S.; PAIXAO, M. Um estudo comparativo entre a visão de líderes e liderados sobre a importância de soft skills em desenvolvimento de software. In: *Anais do IX Workshop sobre Aspectos Sociais, Humanos e Econômicos de Software*. Porto Alegre, RS, Brasil: SBC, 2024. p. 130–140. ISSN 2763-874X. Disponível em: [〈https://sol.sbc.org.br/index.php/washes/article/view/29448-inportuguese〉](https://sol.sbc.org.br/index.php/washes/article/view/29448-inportuguese).
- COHN, M. *Desenvolvimento de software com Scrum: aplicando métodos ágeis com sucesso*. [S.l.]: Bookman, 2000.
- DEMO, P. *Metodologia do conhecimento científico*. [S.l.]: Atlas, 2009 – in portuguese.

- DIERENDONCK, D. V. Servant leadership: A review and synthesis. *Journal of management*, Sage Publications Sage CA: Los Angeles, CA, v. 37, n. 4, p. 1228–1261, 2011.
- DUNAETZ, D. R.; GOBRIL, M.; HOWARD, J.; LORD, J.; YUN, J. C. Self-leadership practices and beliefs in nonprofit organizations: differences between leaders and non-leaders. *Leadership & Organization Development Journal*, Emerald Publishing Limited, 2024.
- DYBÅ, T.; DINGSØYR, T. Empirical studies of agile software development: A systematic review. *Information and software technology*, Elsevier, v. 50, n. 9-10, p. 833–859, 2008.
- ELLAHI, A.; REHMAN, M.; JAVED, Y.; SULTAN, F.; REHMAN, H. M. Impact of servant leadership on project success through mediating role of team motivation and effectiveness: A case of software industry. *SAGE Open*, SAGE Publications Sage CA: Los Angeles, CA, v. 12, n. 3, p. 21582440221122747, 2022.
- FERREIRA, R. G. B. M. *Dynamic team leadership coaching scale: um estudo empírico*. Dissertação (Mestrado) — Universidade de Lisboa (Portugal), 2021.
- FRY, L. W. Toward a theory of spiritual leadership. *The leadership quarterly*, Elsevier, v. 14, n. 6, p. 693–727, 2003.
- GARDNER, W. L.; COGLISER, C. C.; DAVIS, K. M.; DICKENS, M. P. Authentic leadership: A review of the literature and research agenda. *The leadership quarterly*, Elsevier, v. 22, n. 6, p. 1120–1145, 2011.
- GHASABEH, M. S.; SOOSAY, C.; REAICHE, C. The emerging role of transformational leadership. *The Journal of Developing Areas*, Tennessee State University College of Business, v. 49, n. 6, p. 459–467, 2015.
- GRAEFF, C. L. Evolution of situational leadership theory: A critical review. *The Leadership Quarterly*, Elsevier, v. 8, n. 2, p. 153–170, 1997.
- GREN, L.; LINDMAN, M. What an agile leader does: The group dynamics perspective. In: SPRINGER INTERNATIONAL PUBLISHING. *Agile Processes in Software Engineering and Extreme Programming: 21st International Conference on Agile Software Development, XP 2020, Copenhagen, Denmark, June 8–12, 2020, Proceedings 21*. [S.l.], 2020. p. 178–194.
- GREN, L.; RALPH, P. What makes effective leadership in agile software development teams? In: *Proceedings of the 44th International Conference on Software Engineering*. [S.l.: s.n.], 2022. p. 2402–2414.
- HARTOG, D. N. D.; MUIJEN, J. J. V.; KOOPMAN, P. L. Transactional versus transformational leadership: An analysis of the mlq. *Journal of occupational and organizational psychology*, Wiley Online Library, v. 70, n. 1, p. 19–34, 1997.
- HERSEY, P.; BLANCHARD, K. H.; NATEMEYER, W. E. Situational leadership, perception, and the impact of power. *Group & organization studies*, Sage Publications Sage CA: Thousand Oaks, CA, v. 4, n. 4, p. 418–428, 1979.

- HIGHSMITH, J. *Agile software development ecosystems*. [S.l.]: Addison-Wesley, 2002.
- HOGG, M. A. A social identity theory of leadership. *Personality and social psychology review*, Sage Publications Sage CA: Los Angeles, CA, v. 5, n. 3, p. 184–200, 2001.
- HOLTZHAUSEN, N.; KLERK, J. J. de. Servant leadership and the scrum team's effectiveness. *Leadership & Organization Development Journal*, Emerald Publishing Limited, v. 39, n. 7, p. 873–882, 2018.
- HUANG, J. Y.; JIANG, R.; CHANG, J. Y. The effects of transformational and adaptive leadership on dynamic capabilities: Digital transformation projects. *Project Management Journal*, SAGE Publications Sage CA: Los Angeles, CA, v. 54, n. 4, p. 428–446, 2023.
- HUGHES, R.; GINNETT, R. C.; CURPHY, G. J. *Leadership*. Chicago, Irwin, 1996.
- INC., S. E. *2024 Stack Overflow Developer Survey*. 2025. [Online; accessed 2025-01-09]. Disponível em: <https://survey.stackoverflow.co/2024/>.
- JAKOBSSON, K.; SAMIMIAN, T. Agile leadership in new software development contexts. 2023.
- KÄNSÄLÄ, M.; TOKUMARU, N. Interaction between agile methods and organizational culture—a qualitative study. *Pacific Asia Journal of the Association for Information Systems*, v. 15, n. 2, p. 2, 2023.
- KIRKBRIDE, P. Developing transformational leaders: the full range leadership model in action. *Industrial and commercial training*, Emerald Group Publishing Limited, v. 38, n. 1, p. 23–32, 2006.
- KOZLOWSKI, S. W.; WATOLA, D. J.; JENSEN, J. M.; KIM, B. H.; BOTERO, I. C. Developing adaptive teams: A theory of dynamic team leadership. In: *Team effectiveness in complex organizations*. [S.l.]: Routledge, 2008. p. 147–190.
- LI, Y.; TAN, C.-H.; TEO, H.-H.; MATTAR, A. T. Motivating open source software developers: influence of transformational and transactional leaderships. In: *Proceedings of the 2006 ACM SIGMIS CPR conference on computer personnel research: Forty four years of computer personnel research: achievements, challenges & the future*. [S.l.: s.n.], 2006. p. 34–43.
- LIRA, S. A. *Análise de Correlação: Abordagem Teórica e de Construção dos Coeficientes com Aplicações*. Dissertação (Mestrado) — Universidade Federal do Paraná, Brasil, 2004, in portuguese.
- MACFARLAND, T. W.; YATES, J. M.; MACFARLAND, T. W.; YATES, J. M. Mann–whitney u test. *Introduction to nonparametric statistics for the biological sciences using R*, Springer, p. 103–132, 2016.
- MACGREGOR, E.; HSIEH, Y.; KRUCHTEN, P. Cultural patterns in software process mishaps: incidents in global projects. *ACM SIGSOFT Software Engineering Notes*, ACM New York, NY, USA, v. 30, n. 4, p. 1–5, 2005.

- MAROUKIAN, K.; GULLIVER, S. R. The link between transformational and servant leadership in devops-oriented organizations. In: *Proceedings of the 2020 European Symposium on Software Engineering*. [S.l.: s.n.], 2020. p. 21–29.
- MELO, C. de O.; SANTOS, V.; KATAYAMA, E.; CORBUCCI, H.; PRIKLADNICKI, R.; GOLDMAN, A.; KON, F. The evolution of agile software development in brazil: Education, research, and the state-of-the-practice. *Journal of the Brazilian Computer Society*, Springer, v. 19, p. 523–552, 2013.
- MENDONCA, M.; KANUNGO, R. *Ethical leadership*. [S.l.]: McGraw-Hill Education (UK), 2006.
- MEYER, A. N.; FRITZ, T.; MURPHY, G. C.; ZIMMERMANN, T. Software developers' perceptions of productivity. In: *Proceedings of the 22nd ACM SIGSOFT International Symposium on Foundations of Software Engineering*. [S.l.]: ACM, 2014. p. 19–29.
- MODI, S.; STRODE, D. Leadership in agile software development: a systematic literature review. *Australasian Conference on Information Systems*, v. 55, n. 1, p. 13, 2020. Disponível em: (<https://aisel.aisnet.org/acis2020/55>).
- MOE, N. B.; DINGSØYR, T.; DYBÅ, T. Overcoming barriers to self-management in software teams. *IEEE software*, IEEE, v. 26, n. 6, p. 20–26, 2009.
- MOE, N. B.; DINGSØYR, T.; DYBÅ, T. A teamwork model for understanding an agile team: A case study of a scrum project. *Information and software technology*, Elsevier, v. 52, n. 5, p. 480–491, 2010.
- MONAGHAN, C.; BIZUMIC, B.; REYNOLDS, K.; SMITHSON, M.; JOHNS-BOAST, L.; ROOY, D. V. Performance of student software development teams: the influence of personality and identifying as team members. *European Journal of Engineering Education*, Taylor & Francis, v. 40, n. 1, p. 52–67, 2015.
- NORTHOUSE, P. G. *Leadership: Theory and practice*. [S.l.]: Sage publications, 2018.
- OLIVEIRA, R. P. d. et al. *Exploring the turnaway phenomenon: An investigation with software developers*. Tese (Doutorado) — Universidade Federal de Campina Grande, 2023.
- PARRIS, D. L.; PEACHEY, J. W. A systematic literature review of servant leadership theory in organizational contexts. *Journal of business ethics*, Springer, v. 113, p. 377–393, 2013.
- PELINSKI, J.; HONÓRIO, J. L. F.; THIS, T. T.; MELO, Y. Y. M. de; WAGNER, A. F. A liderança dos gestores do futuro na indústria 4.0: uma revisão bibliográfica. *Revista Vitrine*, v. 1, n. 1, 2020.
- RAMIREZ-MORA, S. L.; OKTABA, H. Team maturity in agile software development: The impact on productivity. In: IEEE. *2018 IEEE International Conference on Software Maintenance and Evolution (ICSME)*. [S.l.], 2018. p. 732–736.
- RAY, S. K. S. Moving towards agile leadership to help organizations succeed. *IUP Journal of Soft Skills*, IUP Publications, v. 17, n. 1, p. 5–17, 2023.

- RIAZ, M. N.; MAHBOOB, A.; BURIRO, A. Social success factors affecting implementation of agile software development methodologies in software industry of pakistan: an empirical study. *International Journal of Advanced Computer Science and Applications*, Science and Information (SAI) Organization Limited, v. 9, n. 7, 2018.
- RUNESON, P.; HÖST, M. Guidelines for conducting and reporting case study research in software engineering. *Empirical software engineering*, Springer, v. 14, p. 131–164, 2009.
- RYAN, R. M.; DECI, E. L. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American psychologist*, American Psychological Association, v. 55, n. 1, p. 68, 2000.
- SAKURAI, R.; ZUCHI, J. D. As revoluções industriais até a indústria 4.0. *Revista Interface Tecnológica*, v. 15, n. 2, p. 480–491, 2018.
- SAMPSON, C. J. *How agile leadership can sustain innovation in healthcare*. [S.l.]: LWW, 2023. 1–3 p.
- SCHERMERHORN, J. R. Situational leadership: conversations with paul hersey. *Mid American Journal of Business*, BALL STATE UNIVERSITY, v. 12, p. 5–12, 1997.
- SCRUMSTUDY, A. Guide to the scrum body of knowledge (sbok guide). *VMEdU Inc*, 2016.
- SHARIFHERAVI, M. G.; SHAHIDI, S. E.; MAHMOOD, N. H. N. Investigating the relationships between leadership style and personnel turnover intention in it companies in iran. In: *Proceedings of the 2010 Special Interest Group on Management Information System's 48th annual conference on Computer personnel research on Computer personnel research*. [S.l.: s.n.], 2010. p. 48–54.
- SHMULLER, J. *Análise Estatística com R Para Leigos*. [S.l.]: Alta Books, Rio de Janeiro, 2019, in portuguese.
- SIAKAS, K. V.; SIAKAS, E. The agile professional culture: A source of agile quality. *Software Process: Improvement and Practice*, Wiley Online Library, v. 12, n. 6, p. 597–610, 2007.
- SOMMERVILLE, I. Engenharia de software, 9a. *São Palo, SP, Brasil*, p. 63, 2011 – in portuguese.
- SPIEGLER, S. V.; GRAZIOTIN, D.; HEINECKE, C.; WAGNER, S. A quantitative exploration of the 9-factor theory: Distribution of leadership roles between scrum master and agile team. In: SPRINGER INTERNATIONAL PUBLISHING. *Agile Processes in Software Engineering and Extreme Programming: 21st International Conference on Agile Software Development, XP 2020, Copenhagen, Denmark, June 8–12, 2020, Proceedings 21*. [S.l.], 2020. p. 162–177.
- STOL, K.-J.; FITZGERALD, B. The abc of software engineering research. *ACM Transactions on Software Engineering and Methodology (TOSEM)*, ACM New York, NY, USA, v. 27, n. 3, p. 1–51, 2018.

- STOL, K.-J.; FITZGERALD, B. Guidelines for conducting software engineering research. In: *Contemporary Empirical Methods in Software Engineering*. [S.l.]: Springer, 2020. p. 27–62.
- STRODE, D. E.; HUFF, S. L.; TRETIAKOV, A. The impact of organizational culture on agile method use. In: IEEE. *2009 42nd Hawaii International Conference on System Sciences*. [S.l.], 2009. p. 1–9.
- TOBISCH, F.; SCHMIDT, J.; MATTHES, F. Investigating communities of practice in large-scale agile software development: An interview study. In: SPRINGER. *International Conference on Agile Software Development*. [S.l.], 2024. p. 3–19.
- VARANASI, P. *A Perspective of Leadership Requirement in Scrum Based Software Development-A Case Study*. 2018.
- WALLS, E. The value of situational leadership. *Community practitioner: the journal of the Community Practitioners' & Health Visitors' Association*, Redactive Publishing Ltd., v. 92, n. 2, p. 31–33, 2019.
- WARNER, P. Testing association with fisher's exact test. *Journal of Family Planning and Reproductive Health Care*, British Medical Journal Publishing Group, v. 39, n. 4, p. 281–284, 2013.
- WEICHBRODT, J.; KROPP, M.; BIDDLE, R.; GREGORY, P.; ANSLOW, C.; BÜHLER, U. M.; MATEESCU, M.; MEIER, A. Understanding leadership in agile software development teams: Who and how? In: SPRINGER INTERNATIONAL PUBLISHING CHAM. *International Conference on Agile Software Development*. [S.l.], 2022. p. 99–113.
- YALÇIN, E.; ÖZGENEL, M. The effect of agile leadership on teachers' professional development and performance. *Journal of Educational Leadership and Policy Studies*, Southern Connecticut State University, 2021.
- YANG, H.; HUFF, S.; STRODE, D. Leadership in software development: Comparing perceptions of agile and traditional project managers. 2009.
- YANG, I. Positive effects of laissez-faire leadership: conceptual exploration. *Journal of Management Development*, Emerald Group Publishing Limited, v. 34, n. 10, p. 1246–1261, 2015.
- YIN, R. K. *Case study research: Design and methods*. [S.l.]: sage, 2009. v. 5.

Appendix A

Appendix: Publications

Investigating the Relationship between Software Team Leadership Styles and Turnover Intention - Narallynne Araújo, Tiago Massoni, Camila Sarmento, Francielle Santos, Ruan Oliveira. *On SBES '22: Proceedings of the XXXVI Brazilian Symposium on Software Engineering* - Pages 106 - 111 - ACM Digital Library - <https://doi.org/10.1145/3555228.3555263>

Views on Agile Leadership for Software Teams: A Case Study with Leaders and Non-Leaders- Narallynne Araújo, Tiago Massoni, Lucas Gren. *On SBES '24: Proceedings of the XXXVIII Brazilian Symposium on Software Engineering* - Pages 126-135 - SBC <https://doi.org/10.5753/sbes.2024.3324>

Appendix B

Supplementary material (Case Study)

B.1 Interview Guide - Phase I

This interview is intended to allow the participant to speak freely about the context of his/her team. Let the participant speak freely about his/her work. Try, from time to time, to interpret what the participant is saying in their own words to check that it is correct.

A. Introduction

- Could you tell us a bit about yourself (your background, experiences, technologies you master, etc)?
 - How long have you been working in the area?
- What is your current position/function in the team?
- How big is your team?
- How long have you been working in the company/project?
- What are your current tasks?
- Do you identify with any gender (female/male/non-binary) or do you prefer not to answer?

B. Examples of follow-up questions on agile methods

- What is your experience with agile methods?
- Which agile method do you use in your team today?
- Could you describe what the agile work process looks like in your team today?
- What would you define as the biggest advantages of agile methods in general?

- Do you have any other aspects that you think we have not covered and that you consider to be an important part of agile workin?

C. Examples of follow-up questions on leadership

- Do you see leadership as a function of a particular person or as a property of the team?
 - Can you give an example?
- Is there someone in a leadership role in your team?
- Who would you say is in charge of your team?
- What is the leadership format she/he adopts?
- Does the leader usually distribute leadership activities (decision-making, responsibilities) dynamically with the rest of the team?
 - If so, how does this happen in your view?
- Do you believe that the way the leader distributes these responsibilities is balanced among all members or do you notice any differences?
- How do you receive/exercise these leadership activities?
 - Do you have responsibility for a certain "part" of the development process?
- Do you feel free to make decisions and give opinions?
- Does the fact that other team members have more authority to decide certain situations affect the work of the leaders in any way?
- Do you remember any problems that happened in the team regarding the development process?
 - How did the leader act in the face of this problem?
- What are the biggest challenges of leadership in the agile context?
- What would be effective leadership in an agile context?

D. Finalization.

B.2 Observation Script

A. General

- How do people interact day-to-day?
- What are the day-to-day events that occur in the team?
- What meetings take place in the team?
- When do they take place?
- Where do they take place?
- Who participates?
- Who speaks?
- What is the content?
- What is the team climate like?
- Is there friendship between people?
- How do non-leaders relate to leaders?
- How do leaders relate to non-leaders?
- What is people's level of satisfaction?
- What is the behavior of people when they are charged? Why are they charged?
- How do people express their satisfaction in the project?
- Are there signs of self-organization (individual or group)?
- Are there signs of self-management?

B. In the course of the meetings

- What is the purpose of the meeting?
- Who conducts the meetings?
- How do people behave during meetings?
- Is the information leveled for everyone?
- Is there submission when leaders speak?
- How do leaders behave when women speak?
 - And when men speak?
- How does communication with the client occur?
- Is there a sharing of leadership activities among non-leaders?
 - How does this sharing occur?
 - Are there differences? What are the differences? Where?
- How do non-leaders refer to leaders?
- And the client?
- Is there tension in communication between leaders and other team members?
- When there is a need for project change, how do people behave?
- Do they show excitement or irritation?
- How do non-leaders usually complain about their work?
 - What about leaders?

- What are these indications?
- How do leaders behave in the face of this?
- Do people have the autonomy to do the work?
- Is there tension when clients are mentioned in meetings?
- What is my opinion of the meeting overall?
- What else would you like to add from what was observed?

B.3 Inicial Statements (in portuguese)

Total: 206 statements from MaxQDA

Código de origem	Código	Seg. codificado...
● Trabalho presencial	Comunicação mais efetiva no presencial	2
● Características Equipe A/Time Dell	Liderança afetada devido a falta de experiencia dos não-líderes	2
● Trabalho remoto/hibrido	Hibrido: liberdade de ir e vir	1
● A: Líder/dev especialista	Discute e prioriza o backlog com equipe principal	2
● Desafios enfrentados	A: Falta de comunic. da equipe principal: reforço na comunicaçã	2
● Líderes	B: Acredita que o SP é mais fácil no presencial	1
● Liderança vista como propriedade	Liderança nem sempre presente	3
●	Experiência: Sempre trabalhou com métodos ágeis	8
●	Diferenças na distribuição da liderança: part-time X full-time	3
● Líderes	A: Manter o SP do time é um desafio para a liderança	1
● Distribuição de atividades depende da experiencia	Identifica a disposição dos desenvolvedores	1
● Desafios da liderança	Realizar gestão dos RH	4
● Características Equipe A/Time Dell	Liderança poderia influenciar mais se fosse em tempo integral	1
● Líderes	B: Não perde o SP no remoto, porém exige mais trabalho	1
● Participação do PO na equipe	PO externo não tinha cultura da empresa/B	2
● Líderes	Processo ágil na equipe	6
● Liderança vista como propriedade	Não-líderes com mais autoridade não afeta a liderança	2
● Características Equipe A/Time Dell	Alguns devs não se identifica com atividades de liderança	2
● B: Atividade do líder	Atenção mais individualizada no remoto	2
●	Outros	0
● Distribuição de atividades depende da experiencia	Distrib. da liderança acontece pela aptidão do desenvolvedor	2
● Dispostos à colaboração	Contribui para o aprendizado da equipe	2
● Vantagens dos métodos ágeis	Mitigar problemas em tempo hábil	2
●	Participação do PO na equipe	2
● Método ágil adaptado	Scrum	4
● Vantagens dos métodos ágeis	Melhor visualização das stories/tasks	2
● Não se sente pertencente ao time do lado da E...	Outra equipe tem acesso a recursos que o time não tem	1
● Líder influencia no SP	Liderança aberta a ouvir os não-líderes	3
● Trabalho remoto/hibrido	Ponto negativo do remoto	3
● Observa o SP entre os colegas	Times pequenos são mais unidos	1
● Características Equipe A/Time Dell	Desvantagens do método ágil na equipe	2
● Liderança ausente ou pouco presente	Dev gostaria que o líder/gerente estivesse full time	1
● Identifica a disposição dos desenvolvedores	Não é de impor atribuições se a pessoa não quiser	1
● Formato da liderança adotado/A	Liderança mantinha a comunicação e repasse de informações	3
● Se sente pertencente à equipe	Pôde criar vínculos de amizade	5
● Não há clareza de papéis ágeis	Não havia função clara do Scrum Master	2
● Características Equipe A/Time Dell	Não se sente pertencente ao time do lado da Empresa	1
● Trabalho remoto/hibrido	Hibrido: ajudava o time a criar laços e SP	6
● Líderes	Vantagem dos métodos ágeis	0
● Desafios da liderança	Ter disponibilidade para atender os membros da equipe	8
●	Tempo no projeto	10
● Desafios enfrentados	Mudança de prioridades: sempre leva para o time discutir	1
● Não se sente confortável para opinar na presenç...	Não sente confiança por parte do líder	2
● Liderança efetiva	Fazer com que liderados se sintam parte da solução	1
● Líderes	A: Acredita que o trabalho híbrido/remoto influencia no SP	2
● Liderança efetiva	Estimular o senso de coletivo/colaboração	1
● Formato da liderança adotado/A	Liderança ausente ou pouco presente	3
● Formato da liderança adotado/B	Dev se sente livre para dar opiniões/B	2
● Liderança efetiva	Tomar decisões/Direcionar a equipe de maneira eficiente	4

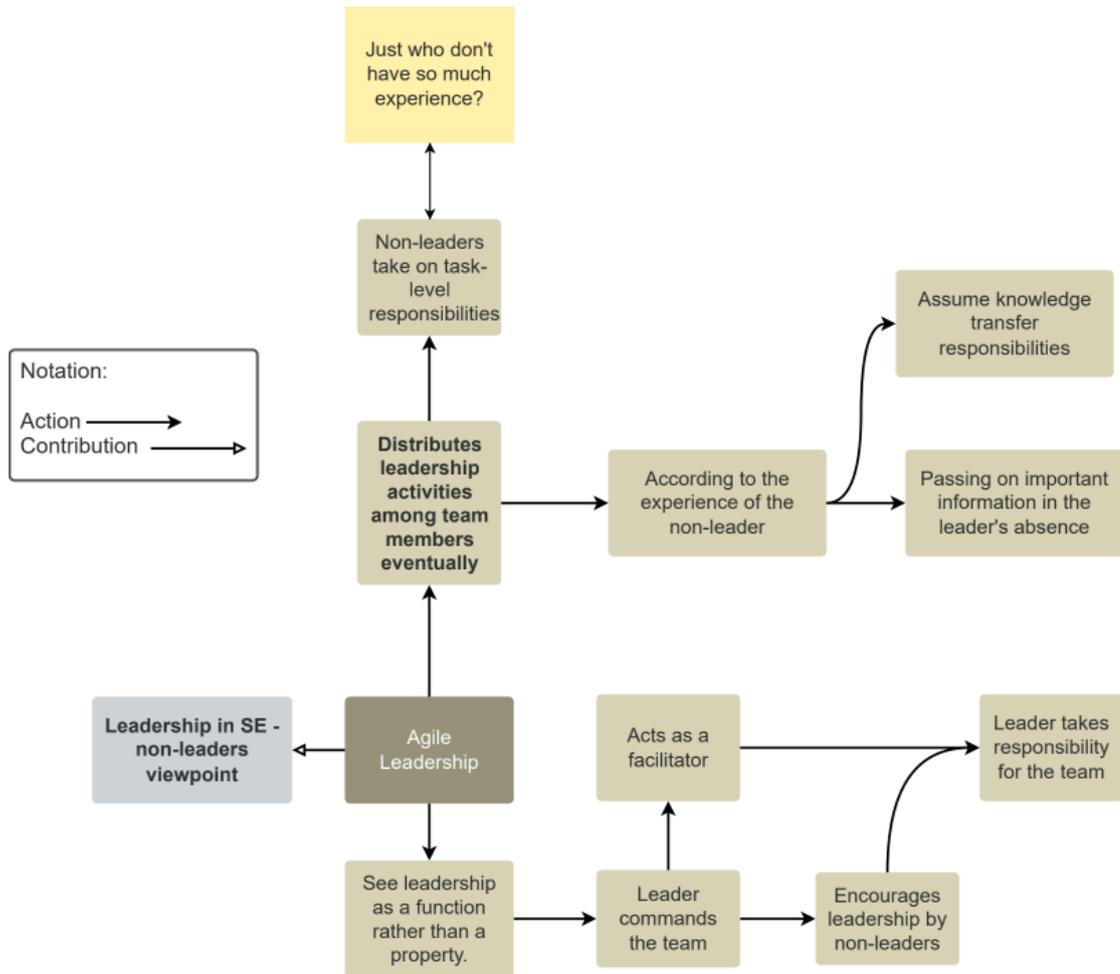
●	Formato da liderança adotado/A	Dev se sente livre para dar opiniões/A	6
●	Liderança vista como propriedade	Líder incentiva a liderança nos não líderes	1
●	Características Equipe A/Time Dell	Graduandos: consideram papel individual devido horários	6
●	Líder está no comando da equipe	O time está no comando apesar do líder responder pelo time	1
●		Dispostos à colaboração	6
●	Ponto negativo do remoto	Falta de contato direto com o time	2
●	Líderes	B: Ver a liderança da equipe atribuída ao líder técnico	1
●	Características Equipe A/Time Dell	Graduandos se encarregam do gerenciamento	5
●		Liderança vista como propriedade	6
●	Definição dos papéis ágeis (1)	Time multidisciplinar	2
●	PO externo não tinha cultura da empresa/B	Era difícil de trabalhar com ele	2
●	Participação do PO na equipe	Não há clareza de quem seja o PO do projeto/A	3
●	Ponto positivo do remoto	Conforto do home office	3
●	Manter a comunicação efetiva	Mais difícil no ambiente remoto	1
●	Líderes	Desafios enfrentados	0
●	Vantagem dos métodos ágeis	Aumentar a produtividade	1
●	Método ágil adaptado: Scrum	Método ágil: kanban ou adaptado	4
●	Participação do PO na equipe	PO disponível para tirar dúvidas sobre requisitos	2
●	Participação do PO na equipe	POs elucidam dúvidas e descrevem as stories	1
●	Liderança efetiva	Estar presente a maior parte do tempo	3
●	Observa o SP entre os colegas	Ajudar os colegas contribuía para o SP	3
●	Se sente pertencente à equipe	Já possuía um nível de amizade com os colegas	1
●	Formato da liderança adotado/A	Dev não possui sentimento positivo quanto a softskill do líder	1
●		Trabalho remoto/híbrido	0
●	Liderança vista como função de uma determina...	Líder está no comando da equipe	8
●	Líderes	B: SP no remoto exige mais atenção e mudanças	1
●	Desafios dos métodos ágeis	Se manter atualizado	1
●	Líderes	Participação do PO na equipe	2
●	Líderes	B: Endomarketing da empresa ajuda a manter o SP	1
●	Diferenças na distribuição da liderança: part-tim...	Por experiência em determinado assunto/A	2
●	Liderança distribuída em alguns momentos	[não-líder]Responsáveis pelo repasse de conhecimento p/ novatos	3
●	Ponto positivo do remoto	Flexibilidade de horários	2
●	Líder influencia no SP	Liderança prestativa	2
●	Aumentar a produtividade	Conseguir atender ao negócio	3
●	Líderes	Distribuição de atividades depende da experiência	3
●	Líderes	Se sentem pertencentes a equipe	2
●	Líderes	B: Bônus dados por mérito (reconhecimento) engaja o SP	0
●		Método ágil adaptado: Scrum	5
●		Líder influencia no SP	3
●	Formato da liderança adotado/B	Time autogerenciável	3
●	Outros	Trabalho colaborativo entre o time	5
●	Formato da liderança adotado/A	Líder participa ativamente do desenvolvimento	2
●	Ver a liderança como uma propriedade da equipe	Estimula a tomada de decisão pelos não líderes	5
●	Atitude do líder diante de um problema	Reorganizar backlog para tarefas atrasadas	4
●	Não se sente pertencente ao time do lado da E...	Não houve auxílio por parte da outra equipe	0
●	Características Equipe B/Time opus	Processo ágil na equipe B	11
●		Atitude do líder diante de um problema	1
●	Realizar entregas concretas	Entregas rápidas	3
●		Sem diferença relacionada ao gênero	6
●	Dev se sente livre para dar opiniões/A	Apenas entre outros não-líderes	1
●		Observa o SP entre os colegas	8
●	Distribuição de atividades depende da experiência	Com menos experientes (novatos), o líder assume a responsab.	2

● Mudança de prioridades: sempre leva para o tim...	Procura sempre ver o lado positivo	2
● Liderança efetiva	Equilibrar vida profissional X pessoal dos integrantes do time	1
● Participação do PO na equipe	Tirava dúvidas quanto aos requisitos	2
● Desvantagens do método ágil na equipe	Cerimônias obrigatórias/exigidas/com pouca flexibilidade	1
● Características Equipe A/Time Dell	Devs alegam dificuldade no onboarding logo que chegam ao proj.	2
● Liderança distribuída em alguns momentos	[não-líder] liderança a nível de tarefas	5
● Diferenças na distribuição da liderança: part-tim...	Por tempo de projeto/B	2
● Desafios dos métodos ágeis	Manter a comunicação efetiva	1
● Processo ágil na equipe B	Mantem o processo ágil, porém sem o tempo de sprint	1
● Não havia função clara do Scrum Master	Prejudicava a comunicação	1
● Vantagens dos métodos ágeis	Adaptação/repriorização quando necessário	2
● Dispostos à colaboração	Colaboração é um valor do time e da empresa	1
● SP no remoto: comunicação efetiva	SP remoto: depende da cultura da equipe	1
● Líderes	A: Acredita que o SP ocorre em diferent níveis ao longo do proj	1
● Trabalho remoto/híbrido	Híbrido/remoto não afeta negativamente na liderança	2
● B: Ver a liderança da equipe atribuída ao líder té...	Se reconhece como um gestor, facilitador	2
● Larga experiência com projetos e tecnologias	Já foi líder anteriormente	2
● Processo ágil na equipe	Reunião de refinamento entre líderes	2
● Desafios da liderança	Tomar decisões arquiteturas	3
● Processo ágil na equipe A	Uso do pair programming para repasse de conhecimento	3
● Realizar gestão dos RH	Líder assume situações sensíveis: ex demissões, emoções dos dev	2
● Líderes	Ver a liderança como uma propriedade da equipe	3
● Características Equipe B/Time opus	Formato da liderança adotado/B	1
● Desafios dos métodos ágeis	Lidar com stakeholders externos	1
● Participação do PO na equipe	Participa da parte de requisitos e negócios	2
● Liderança efetiva	Permitir que o time tenha voz e possam sugerir ideias	1
● Características Equipe A/Time Dell	atividades mal detalhadas geravam expectativas sobre os não-líd	1
● Características Equipe A/Time Dell	Alguns devs apresentam insegurança para falar e opinar	2
● Características Equipe A/Time Dell	A: O líder quem decidia qual story deveria pegar caso dev não e	3
● Processo ágil na equipe	Reuniões podem não ser feitas a depender do desenvolvimento	1
● Líder distribui atividades de forma dinâmica	Graduados responsáveis pelo repasse de conhecimento para grad...	4
● Vantagens dos métodos ágeis	Realizar entregas concretas	3
● Características Equipe A/Time Dell	Inicialmente não havia clareza sobre uso dos métodos ágeis	1
● Função na equipe		10
● Processo ágil na equipe B	Uso de TDD para especificar a parte de testes e desenvolvimento	1
● Líderes	Liderança efetiva	0
● Líder está no comando da equipe	Líder dar autonomia para n-líderes e leva em conta as opiniões	2
● Desvantagens do método ágil na equipe	Code review centrado no líder	2
● Liderança vista como função de uma determina...	Liderança distribuída em alguns momentos	8
● Participação de devs na reunião de líderes	Apenas para tirar dúvidas sobre alguma story	2
● Líderes	Na ausencia do líder, quem assume o comando é um não-líder	2
● Líderes	Larga experiência com projetos e tecnologias	3
● Tomar decisões arquiteturas	Decisões arquitet. que podem afetar no aprendizado dos novatos	1
● Trabalho remoto/híbrido	SP no remoto: comunicação efetiva	2
● Observa o SP entre os colegas	Devido a dinâmica da equipe do que a liderança	2
● Método ágil adaptado	Kanban	3
● Líderes		0
● Desvantagens do método ágil na equipe	Stories pouco especificadas	1

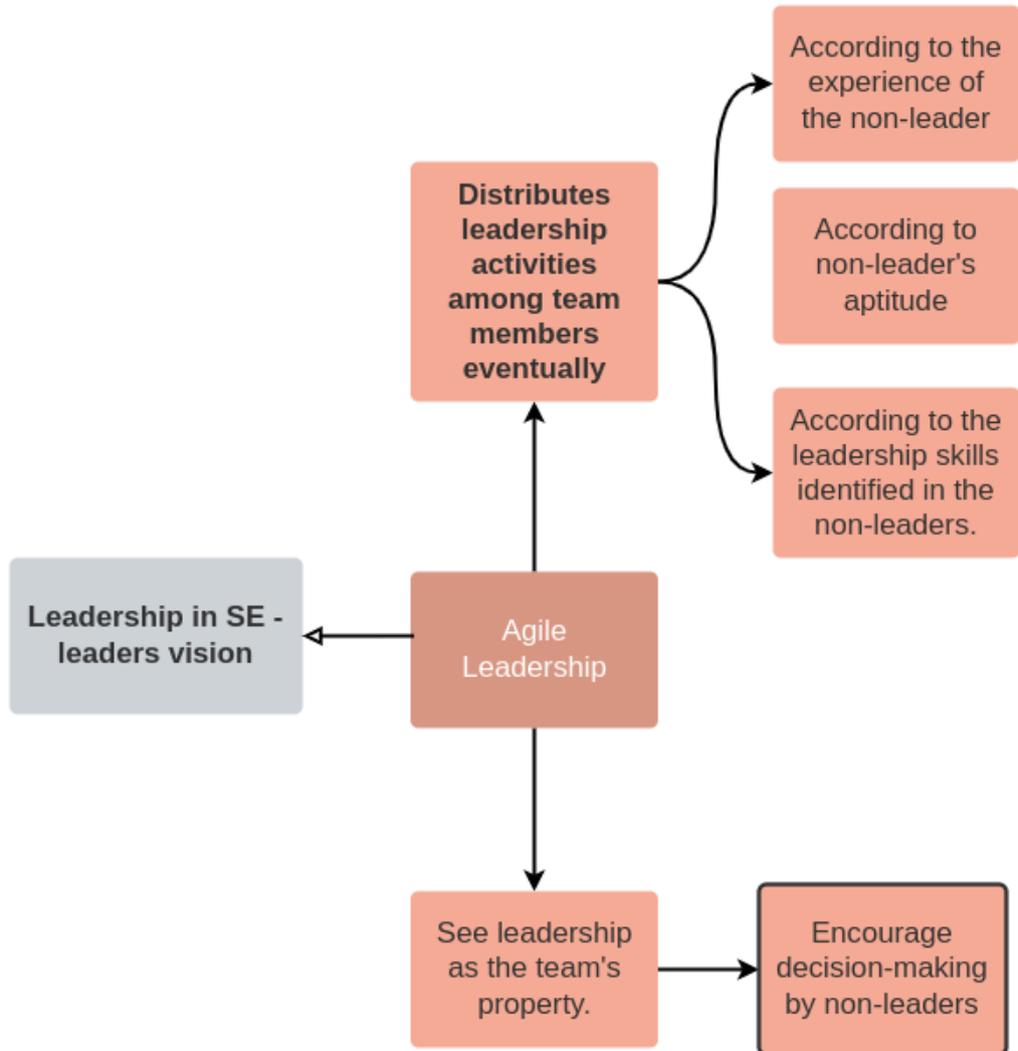
●	Método ágil adaptado	XP	1
●	Características Equipe A/Time Dell	Mulheres: nem sempre se sentiam livres para opinar	1
●	Mulheres: nem sempre se sentiam livres para op...	Opiniões sobre mudança de prazo e/ou requisitos	2
●	Formato da liderança adotado/A	Equipe que é responsável pelo onboarding dos novatos	1
●		Liderança efetiva	1
●	Liderança distribuída em alguns momentos	Distribuição balanceada conforme a carga horária	3
●	Características Equipe A/Time Dell	Definição dos papéis ágeis	2
●	Liderança distribuída em alguns momentos	Distribuição balanceada conforme experiência	4
●	Atitude do líder diante de um problema	Decisão de utilizar ferramenta já conhecida	1
●	Líderes	Papel que se identifica	3
●	Características Equipe A/Time Dell	Dev acredita que liderança é afetada qnd passa para não-líderes	1
●	Não se sente confortável para opinar na presenç...	Líder apresentou comportamento sarcástico	1
●	Papel que se identifica	A: Líder/dev especialista	2
●	A: Líder/dev especialista	Age como um facilitador de desenv. na equipe	3
●	Características Equipe B/Time opus	Definição dos papéis ágeis (1)	2
●	Trabalho remoto/híbrido	Ponto positivo do remoto	0
●	Se sente pertencente à equipe	Pair programming ajudava no senso de pertencimento	2
●	Times pequenos são mais unidos	Existe empatia entre os colegas	1
●	Características Equipe A/Time Dell	Formato da liderança adotado/A	1
●	Se sente pertencente à equipe	Existe empatia entre homens e mulheres	1
●	Desafios da liderança	Gerenciar tempo e tarefas	2
●	Líderes	Método ágil adaptado	5
●	Gerenciar tempo e tarefas	Definir tamanho das stories	1
●	Estimula a tomada de decisão pelos não líderes	Observa se não-líderes estão abertos para receberem responsabil	1
●	Papel que se identifica	B: Gestor colaborativo de pessoas e PO	1
●	B: Atividade do líder	Dar atenção para a equipe, estar presente	2
●	Líderes	Desafios dos métodos ágeis	0
●	Características Equipe A/Time Dell	Processo ágil na equipe A	11
●		Características Equipe B/Time opus	0
●	Atitude do líder diante de um problema	Mediar a discussão com todo o time diante do problema	3
●		Desafios da liderança	2
●	Não se sente pertencente ao time do lado da E...	Não possui autonomia para suas próprias atividades	1
●	Características Equipe A/Time Dell	Autoridade dos não líderes não afeta na liderança	1
●	Participação do PO na equipe	Envolvimento na parte de negócios e requisitos	7
●	Realizar gestão dos RH	Gerenciar mais de um time ou projeto	1
●	Definição dos papéis ágeis	Não há clareza de papéis ágeis	3
●	Dev se sente livre para dar opiniões/A	Não se sente confortável para opinar na presença do líder	1
●		Trabalho presencial	0
●	Reunião de refinamento entre líderes	Participação de devs na reunião de líderes	0
●		Vantagens dos métodos ágeis	5
●	Liderança distribuída em alguns momentos	[não-líder] Tomavam decisões técnicas	2
●	Características Equipe B/Time opus	Liderança não é afetada pelo remoto devido time ser pequeno	1
●		Se sente pertencente à equipe	10
●		Líder distribui atividades de forma dinâmica	4
●	Liderança efetiva	Manter a comunicação efetiva	2
●	Formato da liderança adotado/A	Oferece oportunidades para os não-líderes independente do tempo	2
●		Liderança vista como função de uma determinada pessoa	10
●	Líderes	B: Atividade do líder	0
●	Líder distribui atividades de forma dinâmica	[não-líder] Liderança exercida a nível da story	8
●	Desafios enfrentados	A: Cobrança por parte da eqp principal: mediação e comunicação	1
●	Líderes	B: Ver a liderança como atributos da pessoa	1
●	Características Equipe B/Time opus	Remoto: Difícil para o gestor - muitas reuniões	1
●	Formato da liderança adotado/A	Havia cobranças demasiadas de devs full time	1

B.4 Concept Maps

A. Concept Maps - Non-Leaders' view:



B. Concept Maps - Leaders' view:



B.5 Second Interview: Survey for leaders - Phase II

Team A:

- In the course of the interviews, the team said that leadership is shared mainly with the more experienced developers.
 - How do you see this sharing of your leadership with others?
 - Regarding the experience of this developer, is this related to him/her having more experience in the technologies/tools used and experience in previous projects? Or is it because of the time he/she has been in the project?
- Developers with leadership profiles are observed for the frequency in which they give opinions and suggestions, for their soft skills related to leadership, etc. Sometimes, in your absence, they are ready to pass on the information and already have a certain period of participating in the project. Can you confirm this statement?
- Do less experienced developers need a certain confirmation/permission from you to give their opinion during the meetings?
- In the retrospective meeting, the rotation between developers to conduct the meeting can be seen as an example of sharing leadership activities. Did developers from the university side ever participate?
- During the observation process, a more experienced developer felt the need to do internal retrospectives. He suggested it and did all the organization, communicating it to his colleagues. Did this meeting (internally) continue to happen?
 - With these meetings, what did you observe as positive and/or negative in the team?
 - Was there a rotation between people to conduct the meeting as well?
- How do you describe yourself as a leader?
- How do you describe your leadership?

Team B:

- In the retrospective meeting observed, you recognized one of the senior developers as one of the system owners, giving him full autonomy to exercise decision-making within the team.
 - How do you see the sharing of your leadership with others?
 - About the experience of this developer, is it related to him having more experience in the technologies/tools used, and

B.6 Nomination and refinement of Themes

Non-leaders' view of agile and effective leadership			
Theme	Category	Subcategory	Quote
Situational leadership	Leadership as a function	Leadership as an individual role	<ul style="list-style-type: none"> ● <i>“I see it more as a function assigned to one person. So, I believe that various people in our team have aspects and points of leadership, but I think there has to be a leader.” - P5</i> ● <i>I see it as attributed to a person, from the beginning we knew that (the leader) had this function of manager (...)</i> - P1 ● <i>We also make some minor decisions, for example, alternative ways of implementing what is being asked (...) when we see that there is a better way of doing it, and we always have that freedom to decide. But for me, the real leader is (name of leader).” - P6</i> ● <i>“I think I see it mainly as a function given to one person and not really the team.” - P3</i> ● <i>“Normally, I see decision-making at the architecture level, at the level of how I'm going to do something, it's normally centralized in these people (from the company). (...) And (name of leader) is our leader here on the University side” - P4</i> ● <i>“In charge of the team, so speaking in an efficient way (leader's name)” - P2</i>
Dynamic Team Leadership	Leadership as a team property	Colective property	<ul style="list-style-type: none"> ● <i>“I particularly think it's a property of the team because I believe that you don't necessarily have to be in a managerial position to take some leadership directive. (...) I believe that it wouldn't necessarily all have to be associated with a managerial figure (...)</i>” - P2 ● <i>I'd say it's more of a team property</i>

			<p><i>within agile. Within Agile, you sometimes have to take on roles that require leadership characteristics. So, for example, in the absence of the leader I sometimes play the midfield leader role. (...) Sometimes you need to put your leadership hat on to get the business moving.” - P8</i></p>
Situational leadership	Distributes leadership	According to the experience of the non-leader	<ul style="list-style-type: none"> ● <i>“Especially when there were problems in the database, because I had experience in this, I was left to decide the pairs, so he [the leader] put me in these stories.” - P5</i> ● <i>“Only in some moments that maybe some decisions had a very big weight, taking into account the roles within the team (...) like someone being responsible for a very large refactoring and the person being still undergraduate and not having so much experience on this.” - P1</i> ● <i>“He usually distributes. That's how I think it starts from the understanding that there are people who know more than others...” - P3</i>
		According to team tenure	<ul style="list-style-type: none"> ● <i>“(...) I don't think (the leader) would give me a role, (...) Because there are people on the team who have been there longer than I am and can deal with it much better than I can.” - P9</i> ● <i>“There is a difference about part-time (undergraduates) because he (the leader) generally prefers to assign to full-time (graduates) due to availability. So those of us who are full-time have a better view of what's going on” - P6.</i> ● <i>“When there are new people on the team, he always tries to get them to</i>

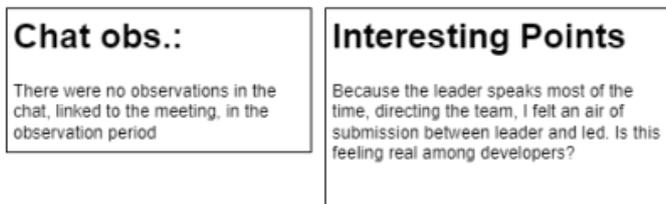
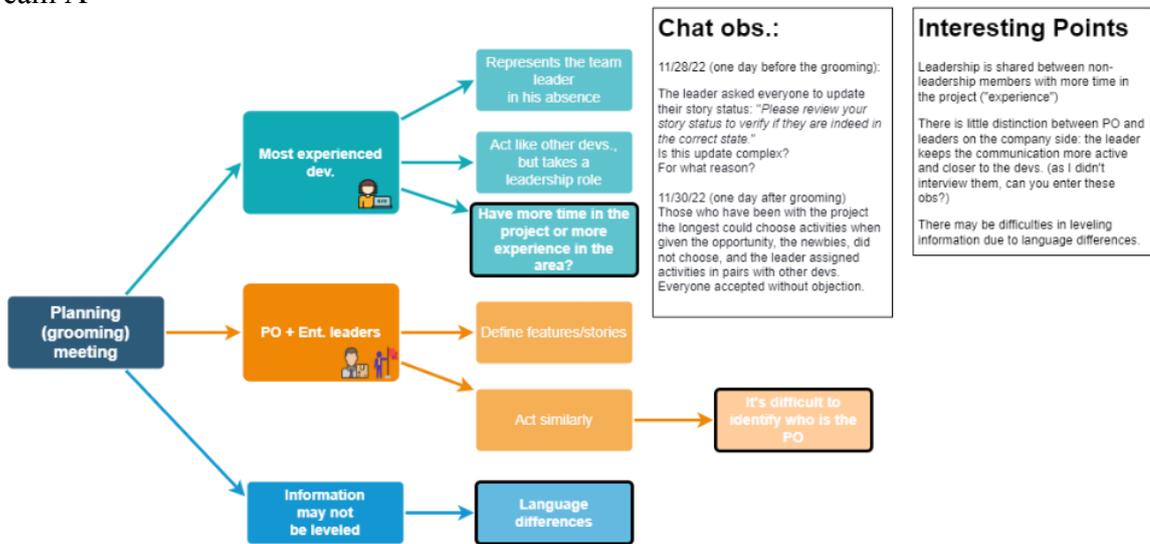
			<p><i>work in pair programming so that the knowledge can be passed on to these new people. Now, there are new people, and there was a time when two new people joined the team part-time. (...)</i>” - P4</p> <ul style="list-style-type: none"> • <i>“(...) we have people who work half time, people who work full time, so it's not the same (the balancing) because otherwise it would overload someone...”</i> - P3
		<p>Team size matters</p>	<ul style="list-style-type: none"> • <i>“(...) my team has reached a level where we are so close that when things go wrong, let's put it that way, we get together and solve the problem (...). So our coexistence is very harmonious (...). I feel part of where I am, and I feel good about it”</i> - P8 • <i>“I think it's at this time [under pressure] that we see constant conversation and concern for everyone. I think the fact that we're a small team also contributes a lot because we stick together”</i> - P9.
<p>Dynamic Team Leadership</p>	<p>Leadership as a team property</p>	<p>Colective property</p>	<ul style="list-style-type: none"> • <i>“I particularly think it's a property of the team because I believe that you don't necessarily have to be in a managerial position to take some leadership directive. (...) I believe that it wouldn't necessarily all have to be associated with a managerial figure (...)”</i> - P2 • <i>I'd say it's more of a team property within agile. Within Agile, you sometimes have to take on roles that require leadership characteristics. So, for example, in the absence of the leader I sometimes play the midfield leader role. (...) Sometimes you need to put your leadership hat on to get the</i>

			<i>business moving.” - P8</i>
Leaders' view of agile and effective leadership			
Dynamic Team Leadership	Leadership as a team property	Colective property	<ul style="list-style-type: none"> ● <i>“I see it as ownership. In fact, the vast majority of what I do is discuss, together, we come up with a solution. So (...) we discuss and build the solution. Even from the point of view of taking responsibility, I also encourage the staff to do this (...).” - P7.</i> ● <i>“I see it as a way of keeping more than one person aware of the overall vision of the project and aware at a deeper level of detail about what everyone (or most everyone) was working on.” - P7. “It’s not just one position, right? (the leadership). There’s a developer who is also, let’s say, an unnamed technical leader: who is the guy who knows the most about the product.” - P11.</i>
	Distributes leadership	According to the experience of the non-leader	<ul style="list-style-type: none"> ● <i>“...there are people in the team who, regardless of whether they are undergraduates or graduates, already have that degree of taking on a story. (...) Some people in the team don’t yet have this sense of responsibility or commitment.” - P7</i> ● <i>“I think leadership is a question of skill and maturity, right? You learn about it, you study about it (...)</i>
		According to team tenure	<ul style="list-style-type: none"> ● <i>Even one of the project members who had already left (had been on the team for longer) took on the responsibility to take on the role of leader while I was away (...), to try to make life easier for the other members in some development scenarios (...) - P7</i> ● <i>We have a technical leader... he knows</i>

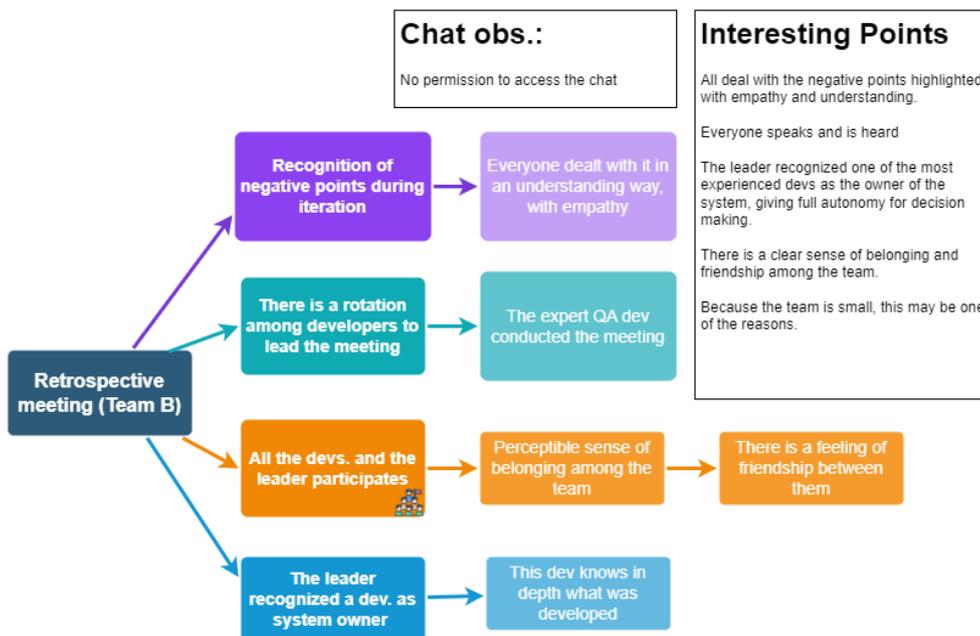
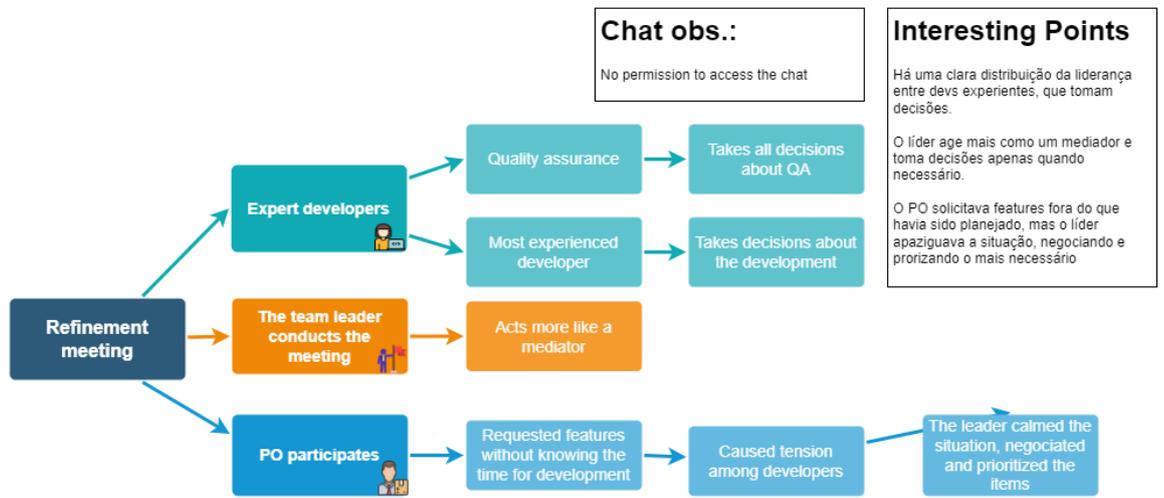
<p>Situational Leadership</p>			<p><i>the most about the product (because he's been with the project since the beginning) (...).” - P11</i></p>
		<p>Leadership aptitudes matters</p>	<ul style="list-style-type: none"> ● <i>“More than the developer’s experience in the project or previous projects, what was taken into account was the developer’s interest in taking on this role in the execution of the project.” - P7</i> ● <i>“I think leadership is a question of skill and maturity, right? You learn about it, you study about it, but if you don’t have the skills (...), you can’t lead. (...) So, I think that agile leadership is made up of your motivation and your technical leadership, right? (...).” - P11.</i>
<p>Situational Leadership</p>	<p>Leadership as a team property</p>	<p>Colective property</p>	<ul style="list-style-type: none"> ● <i>I exercise a situational leadership, with elements of transformational leadership, but taking care that the idealization of the objectives remains in the cause to be achieved and not linked to the figure of the leader.” - P11.</i> ● <i>“The sharing of leadership, in my view, should be done in layers of leadership (Strategic, Tactical, and Operational). (...) Operational - technical level, (...) can be delegated and only needs monitoring. At the tactical level, leadership is shared, but decisions require consultation and approval. The strategic ones cannot and should not be delegated because they are actions taken in another company sphere with PO and Business.” - P11.</i>

B.7 Examples of Observation Mind Maps

Team A



Team B



Appendix C

Supplementary material (Survey)

C.1 Questionnaire - in portuguese

Um pouco sobre você

Qual a sua faixa etária

- Menos de 18 anos
- Entre 18 e 25 anos
- Entre 26 e 35 anos
- Entre 36 e 45 anos
- Entre 46 e 55 anos
- Mais de 55 anos

Qual a sua identidade de gênero

- Mulher
- Homem
- Não-binário, genderqueer, ou gênero não-conformista
- Prefere não dizer
- Ou, em suas próprias palavras

Atualmente, você ocupa uma posição de liderança?

<i>Se sim, qual a sua posição hoje?</i>	<i>Se não, qual a sua posição hoje?</i>
Líder técnico Gerente de engenharia Gerente de produto Gerente de projetos Coordenador(a) Diretor(a) Outro	Desenvolvedor(a) (full-stack, back-end, front-end) Desenvolvedor(a) (QA ou teste) Educador(a) Administrador(a) de banco de dados Função de pesquisa e desenvolvimento Designer

	Cientista Experiência de desenvolvedor(a) Administrador(a) de sistemas Especialista em DevOps Profissional de segurança Engenheiro(a) de infraestrutura de nuvem Engenheiro(a) de hardware Pesquisador(a) acadêmico Analista de dados ou de negócios Engenheiro(a) de dados Cientista de dados ou especialista em aprendizado de máquina Estudante Outro
--	--

Sua escolaridade

- Superior incompleto
- Superior completo
- Mestrado (acadêmico, profissional, MBA)
- Doutorado
- Outro

Há quanto tempo você está na sua atual equipe?

- Menos de 1 ano
- De 1 a 4 anos
- 5 a 9 anos
- 10 a 14 anos
- 15 a 19 anos
- Mais de 20 anos

Há quanto tempo você tem experiência na área de tecnologia da informação?

- Menos de 1 ano
- De 1 a 4 anos
- 5 a 9 anos
- 10 a 14 anos
- 15 a 19 anos
- 20 a 24 anos
- 25 a 29 anos
- Mais de 30 anos

Qual o tamanho da sua equipe (quantidade de membros, incluindo você)?

- Menor que 3 pessoas
- Entre 3 e 5 pessoas

- Entre 5 e 9 pessoas
- Mais de 9 pessoas

FULL RANGE LEADERSHIP MODEL 6S - BASS & AVOLIO

Avaliação de liderança que você recebe

Responda às seguintes perguntas sobre seu líder e a liderança que ele exerce sobre você. Se você tiver mais de um líder, responda sobre o mais próximo ou o mais imediato.

Cada pergunta tem uma pontuação de 0 (zero) a 4 (quatro), sendo que

0 = Nem um pouco

1 = De vez em quando

2 = Às vezes

3 = Frequentemente

4 = Frequentemente, quando não sempre

Não-líderes	Líderes
1. O(a) meu(minha) líder faz os outros se sentirem bem por estarem perto dele.	1. Eu faço os outros se sentirem bem por estar perto de mim.
2. O(a) meu(minha) líder expressa com poucas palavras simples o que posso e devo fazer.	2. Expresso com poucas palavras simples o que podemos e devemos fazer.
3. O meu líder permite que eu pense nos problemas antigos de novas maneiras.	3. Permito que outras pessoas pensem nos problemas antigos de novas maneiras.
4. O(a) meu(minha) líder ajuda-me a me desenvolver.	4. Ajudo os outros a se desenvolverem.
5. O(a) meu(minha) líder me diz o que fazer se eu quiser ser recompensado(a) pelo meu trabalho.	5. Digo aos outros o que fazer se quiserem ser recompensados por seu trabalho.
6. O(a) meu(minha) líder fica satisfeito(a) quando cumpro os padrões acordados.	6. Fico satisfeito quando outras pessoas cumprem os padrões acordados.
7. O(a) meu(minha) líder fica contente em me permitir que eu	7. Fico contente em permitir que outras pessoas continuem trabalhando da mesma maneira que sempre.

continue trabalhando da mesma maneira de sempre.	
8. Eu tenho completa fé no(a) meu (minha) líder.	8. outros confiam plenamente em mim.
9. O(a) meu(minha) líder fornece imagens atrativas sobre o que eu posso fazer.	9. Forneço imagens atraentes sobre o que podemos fazer.
10. O(a) meu(minha) líder me fornece novas maneiras de encarar coisas intrigantes.	10. Forneço aos outros novas maneiras de encarar coisas intrigantes.
11. O(a) meu(minha) líder me diz como ele acha que eu estou indo.	11. Eu digo aos outros como eu acho que eles estão indo.
12. O(a) meu(minha) líder oferece reconhecimento/recompensa quando eu atinjo meus objetivos.	12. Ofereço reconhecimento / recompensa quando outros atingem seus objetivos.
13. Enquanto as coisas estiverem funcionando, o(a) meu(minha) líder tenta não mudar nada.	13. Enquanto as coisas estiverem funcionando, não tento mudar nada.
14. Tudo o que eu quero fazer está bem/OK com o meu(minha) líder.	14. Tudo o que os outros querem fazer está bem comigo.
15. Eu tenho orgulho de estar associado ao(à) meu(minha) líder.	15. Outros têm orgulho de estar associados a mim.
16. O(a) meu(minha) líder me ajuda a encontrar significado em meu trabalho.	16. Ajudo outras pessoas a encontrar significado em seu trabalho.
17. O(a) meu(minha) líder faz com que eu repense idéias que nunca havia me questionado antes.	17. Faço com que outras pessoas repensem idéias que nunca haviam questionado antes.
18. O(a) meu(minha) líder me dá atenção pessoal quando me sinto estar rejeitado(a).	18. Dou atenção pessoal a outras pessoas que parecem rejeitadas.

19. O(a) meu(minha) líder chama a atenção para o que eu posso obter pelo que eu realizo.	19. Chamo a atenção para o que os outros podem obter pelo que realizam.
20. O(a) meu(minha) líder me diz os modelos/padrões que eu preciso conhecer para realizar meu trabalho.	20. Digo aos outros os padrões que eles precisam conhecer para realizar seu trabalho.
21. O(a) meu(minha) líder não me pede mais do que aquilo que é absolutamente essencial.	21. Não peço mais aos outros do que aquilo que é absolutamente essencial

3 - De acordo com as suposições a seguir, avalie a importância dos aspectos que podem contribuir para a ocorrência de cada situação. Os aspectos são: tempo de permanência no time, tempo de experiência na área, tamanho do time e aptidão para determinadas atividades de liderança.

Considere o nível de importância de 0 (zero) a 4 (quatro), sendo que:

0 = Não é nada importante

1 = As vezes é importante

2 = Mediana

3 = Importante

4 = Muito importante

Para cada aspecto, determine o nível de importância para cada situação.

Não-líderes	Líderes
<i>Seu líder está de férias e um dos seus colegas foi escolhido para assumir essa posição durante esse período. Esse colega mantém uma comunicação constante com todos vocês, garantindo que todos tenham clareza sobre suas atividades e responsabilidades, monitorando o progresso e informando ao líder, caso necessite alguma intervenção.</i>	<i>Você entrou de férias e escolheu um dos desenvolvedores do seu time para substituir você nesse período. Esse desenvolvedor mantém uma comunicação constante com todos durante a sua ausência, garantindo que todos tenham clareza sobre suas atividades e responsabilidades, monitorando o progresso e informando avocê, caso necessite da sua intervenção.</i>

<p>Na sua opinião, qual a importância dos fatores abaixo para que o líder tenha escolhido esse colega em específico?</p> <p>Tempo de permanência desse colega no time Tempo de experiência desse colega na área Tamanho do time Aptidão desse colega para assumir esse tipo de atividade</p>	<p>Na sua opinião, qual a importância dos fatores abaixo para que você tenha escolhido esse desenvolvedor em específico?</p> <p>Tempo de permanência desse desenvolvedor no time Tempo de experiência desse desenvolvedor na área Tamanho do time Aptidão desse desenvolvedor para assumir esse tipo de atividade</p>
--	---

Não-líderes	Líderes
<p><i>Seu líder é um líder presente e empático. Você não tem receio para fazer qualquer pergunta e sente-se confortável na presença dele. Em uma reunião de retrospectiva, ele deixou claro que um dos seus colegas possui total propriedade sobre o que vocês estão desenvolvendo e que esse colega pode responder pelo time em sua ausência.</i></p>	<p><i>Os membros do seu time não tem receio para fazer qualquer pergunta para você e sentem-se confortáveis na sua presença. Em uma reunião de retrospectiva, você deixa claro que um dos desenvolvedores possui total propriedade sobre o que o time está desenvolvendo e atribui a ele a responsabilidade de responder pelo time em sua ausência.</i></p>
<p>Na sua opinião, qual a importância dos fatores abaixo para que a liderança tenha se expressado sobre esse desenvolvedor em específico?</p> <p>Tempo de permanência desse desenvolvedor no time Tempo de experiência desse desenvolvedor na área Tamanho do time Aptidão desse desenvolvedor para assumir esse tipo de atividade</p>	<p>Na sua opinião, qual a importância dos fatores abaixo para que você tenha se expressado sobre esse desenvolvedor em específico?</p> <p>Tempo de permanência desse desenvolvedor no time Tempo de experiência desse desenvolvedor na área Tamanho do time Aptidão desse desenvolvedor para assumir esse tipo de atividade</p>

Não-líderes	Líderes
<p><i>Uma das suas colegas desenvolvedoras relatou um impedimento durante a reunião de refinamento. O líder lhe perguntou se ela sabia como resolver o</i></p>	<p><i>Uma das desenvolvedoras do time relatou um impedimento durante a reunião de refinamento. Você perguntou para ela se ela sabia como resolver o</i></p>

<i>problema. Ela falou a sua ideia de resolução. O líder aceitou a ideia de resolução e disse que confiava nela.</i>	<i>problema. Ela falou que sim e deu a sua ideia de resolução. Você aceitou a ideia de resolução dela e disse que confiava nela. Todos do time estavam presentes.</i>
Na sua opinião, qual a importância dos fatores abaixo para que a liderança tenha se expressado sobre essa desenvolvedora em específico? Tempo de permanência dessa desenvolvedora no time Tempo de experiência dessa desenvolvedora na área Tamanho do time Aptidão dessa desenvolvedora para assumir esse tipo de atividade	Na sua opinião, qual a importância dos fatores abaixo para que você tenha se expressado sobre essa desenvolvedora em específico? Tempo de permanência dessa desenvolvedora no time Tempo de experiência dessa desenvolvedora na área Tamanho do time Aptidão dessa desenvolvedora para assumir esse tipo de atividade

Não-líderes	Líderes
<i>Em uma reunião diária, o líder informou que discutiu com o PO (Product Owner) algumas decisões estratégicas (relacionadas ao plano de negócios). De acordo com essas decisões, o líder atribuiu a uma de suas colegas (especialista em testes) que ela definisse as atividades do backlog da sprint.</i>	<i>Em uma reunião diária, você informou que discutiu com o PO (Product Owner) algumas decisões estratégicas (relacionadas ao plano de negócios). De acordo com essas decisões, você atribuiu a uma das desenvolvedoras (especialista em testes) que ela definisse as atividades do backlog da sprint.</i>
Na sua opinião, qual a importância dos fatores abaixo para que a liderança tenha agido de tal maneira? Tempo de permanência dessa colega no time Tempo de experiência dessa colega na área Tamanho do time Aptidão dessa colega para assumir esse tipo de atividade	Na sua opinião, qual a importância dos fatores abaixo para que você tenha feito essa escolha? Tempo de permanência dessa desenvolvedora no time Tempo de experiência dessa desenvolvedora na área Tamanho do time Aptidão dessa desenvolvedora para assumir esse tipo de atividade

C.2 R Code - Statistics analysis

The R Code are available at the Github repository: [⟨https://github.com/narallynne/quantitative-analysis⟩](https://github.com/narallynne/quantitative-analysis)

Appendix D

Annexes

D.1 Informed Consent Form (Qualitative and Quantitative Studies)- in portuguese

(ESTUDO QUALITATIVO)

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

Em conformidade com o Comitê de Ética em Pesquisa em Seres Humanos - CEP, Universidade Federal de Campina Grande - UFCG, Hospital Universitário Alcides Carneiro – HUAC.

Você foi convidado(a) a participar da pesquisa intitulada “Liderança Efetiva em Equipes Ágeis de Desenvolvimento de Software” por meio de entrevistas e observações sobre o processo de desenvolvimento adotado por sua equipe. Esta pesquisa tem como objetivo investigar o papel da liderança efetiva nas equipes ágeis de software e possíveis diferenças entre gênero. Ao participar da pesquisa, você concorda com todas as informações apresentadas a seguir. Sua colaboração neste estudo será de muita importância para nós, mas, caso queira desistir a qualquer momento, isso não lhe causará nenhum prejuízo.

Esta é uma pesquisa puramente acadêmica, **sem nenhum interesse comercial**. Todas as informações solicitadas nas entrevistas e observações serão tratadas de forma **anônima**, garantindo a confidencialidade dos participantes e das informações por eles prestadas.

Pesquisadores responsáveis:

Prof. Dr. Tiago Massoni (DSC/UFCG)

Ma. Narallynne Araújo (DSC/UFCG)

Kamila Albuquerque (DSC/UFCG)

INFORMAÇÕES SOBRE A PESQUISA E SUA PARTICIPAÇÃO

Ao participar da pesquisa, você está ciente de que:

I - O estudo se faz necessário para que se possa investigar o papel da liderança efetiva nas equipes ágeis de software e possíveis diferenças entre líderes e não líderes, homens e mulheres. Especificamente, as entrevistas e observações irão: obter informações sobre a sua função na empresa/projeto em que trabalha, verificar informações sobre a liderança que você exerce/recebe e se/como ela é distribuída de forma dinâmica entre o time de desenvolvimento, como também se gera um senso de pertencimento à equipe e ao trabalho desenvolvido por ela;

II - A pesquisa consiste em um estudo de caso exploratório de abordagem qualitativa. A coleta de dados será através de entrevistas e observações no decorrer de reuniões, *chats* e documentações que possam ser acessíveis aos pesquisadores. A amostra será composta por profissionais de software que podem exercer funções diversas, incluindo líderes de equipe e não-líderes. O método para análise dos dados são critérios qualitativos de anotações, observações e codificações indutivas;

III - O estudo proposto poderá trazer riscos mínimos, visto que pode trazer constrangimento ou desconforto durante a entrevista ou no decorrer do processo de observação, além do tempo disponibilizado para a mesma. Visando minimizar os riscos da pesquisa, a entrevista poderá ser feita de forma remota, via aplicativo de vídeo-chamada, entre o(a) entrevistado(a) e dois(a) ou três pesquisadores, onde o(a) entrevistado(a) poderá participar no local e horário que se sentir mais confortável. Os benefícios da pesquisa podem ser vistos através de várias perspectivas: (i) da ótica organizacional, refere-se aos processos ágeis mais eficazes (com foco na liderança) utilizados pelas empresas de desenvolvimento para favorecer o desenvolvimento de produtos e/ou serviços de forma satisfatória para os usuários, podendo gerar menor custo financeiro e maior competitividade; (ii) do ponto de vista da profissão, pode-se ter uma melhoria no processo de liderança, vindo à maximizar o desenvolvimento de *soft skills* em todos os membros da

equipe e a capacidade de tomada de decisão de forma dinâmica, como também a qualidade e entrega dos serviços, minimizando problemas práticos que podem surgir no decorrer do processo ágil; (iii) do ponto de vista científico, a pesquisa contribuirá para um melhor entendimento sobre a liderança ágil de forma efetiva nas empresas de software, embasando pesquisas futuras sobre o tema, tendo em vista que ainda é um tema pouco explorado na área sobre aspectos humanos em Engenharia de Software;

IV - Você tem a liberdade de, a qualquer momento que desejar, entrar em contato para obter informações sobre esta pesquisa, sobre a sua participação ou outros assuntos relacionados à mesma através do contato com as pesquisadoras, pelos telefones: (83) 98773-2333 e (83) 99158-0844; e através dos e-mails: narallynne@copin.ufcg.edu.br; kamila.albuquerque@ccc.ufcg.edu.br.

V - Você tem a liberdade de desistir ou de interromper a sua colaboração neste estudo quando desejar, sem necessidade de qualquer explicação;

VI - Os dados obtidos por meio desta pesquisa serão **confidenciais e não serão divulgados em nível individual**, visando assegurar o sigilo e a privacidade dos participantes durante todas as fases da pesquisa:

a) Em relação ao uso de arquivos e/ou documentos do projeto ou equipe nos quais o participante está inserido, fica garantido que:

(i) Os dados serão usados unicamente para fins científicos;

(ii) Em nenhum momento da pesquisa os nomes dos participantes ou da empresa que constam nos arquivos e/ou documentos serão divulgados;

(iii) O participante tem a liberdade para desistir de permitir o acesso aos arquivos e/ou documentos a qualquer momento, sem ser penalizado fisicamente, financeiramente e moralmente;

(iv) Ao final da pesquisa, se for do interesse de ambas as partes, o participante terá livre acesso ao conteúdo da mesma, podendo discutir os dados com os(as) pesquisadores(as).

VII - Os resultados obtidos durante esta pesquisa serão mantidos em sigilo, mas, ao participar da entrevista, você concorda que sejam divulgados em publicações científicas, uma vez que garantimos que seus dados pessoais e empresariais jamais serão mencionados;

VIII - Após a pesquisa, poderemos entrar em contato com você novamente, por e-mail ou telefone, seja para confirmar algumas informações solicitadas durante a entrevista, ou mesmo para obter novas informações.

IX - Caso se sinta prejudicado(a) por participar desta pesquisa, poderá recorrer ao Comitê de Ética em Pesquisas com Seres Humanos – CEP, do Hospital Universitário Alcides Carneiro - HUAC, situado a Rua: Dr. Carlos Chagas, s/ n, São José, CEP: 58401 – 490, Campina Grande-PB, Tel: 2101 – 5545, e-mail: cep@huac.ufcg.edu.br; Conselho Regional de Medicina da Paraíba e a Delegacia Regional de Campina Grande.

Eu, [nome], portador(a) do CPF: [numero do CPF], concordo de livre e espontânea vontade em participar como voluntário(a) do estudo “Liderança Efetiva em Equipes Ágeis de Desenvolvimento de Software”. Declaro que obtive todas as informações necessárias, bem como todos os eventuais esclarecimentos quanto às dúvidas por mim apresentadas.

Campina Grande/PB,

_____ de _____ de _____,

Assinatura do(a) voluntário(a).

(ESTUDO QUANTITATIVO)

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

Em conformidade com o Comitê de Ética em Pesquisa em Seres Humanos - CEP, Universidade Federal de Campina Grande - UFCG, Hospital Universitário Alcides Carneiro – HUAC.

Você foi convidado(a) a participar de um estudo que visa avaliar a sua percepção sobre atividades de liderança em equipes ágeis de desenvolvimento de software por meio de um ou mais meios de coleta de dados, podendo ser entrevistas, questionário ou grupo focal. Esta pesquisa faz parte da tese de doutorado da aluna Narallynne Araújo, pós-graduanda do Programa de Pós-Graduação em Ciências da Computação da Universidade Federal de Campina Grande. A pesquisa tem como objetivo investigar o papel da liderança efetiva nas equipes ágeis de software e possíveis diferenças percebidas entre líderes e não-líderes,

verificando onde que essas diferenças podem interferir no processo de desenvolvimento. Ao participar da pesquisa, você concorda com todas as informações apresentadas a seguir. Sua colaboração neste estudo será de muita importância, mas, caso queira desistir a qualquer momento, isso não lhe causará nenhum prejuízo.

Ademais, esta é uma pesquisa puramente acadêmica, **sem nenhum interesse comercial**. Todas as informações solicitadas no questionário serão tratadas de forma **anônima**, garantindo a confidencialidade das(os) participantes e das informações por elas(eles) prestadas.

Pesquisadora responsável: Ma. Narallyne Araújo (PPGCC/UFCG)

Orientador: Prof. Dr. Tiago Massoni (DSC/UFCG)

INFORMAÇÕES SOBRE A PESQUISA E SUA PARTICIPAÇÃO

Ao participar da pesquisa, você está ciente de que:

I - Este estudo se faz necessário para que se possa investigar o papel da liderança efetiva nas equipes ágeis de software e possíveis diferenças entre líderes e não líderes. Especificamente, os meios de coleta de dados irão obter informações sobre a sua função na equipe/projeto em que trabalha, sua experiência e algumas informações pessoais como idade e gênero. Também irá verificar informações sobre a liderança que você exerce/recebe e a sua opinião quanto a importância de algumas situações relacionadas à liderança que podem ocorrer em equipes ágeis de desenvolvimento de software;

II - Esta pesquisa consiste em um estudo de amostra de abordagem quanti-qualitativa. A coleta de dados poderá ser através de questionário online ou grupo focal. A amostra será composta por profissionais de software que podem exercer funções diversas, incluindo líderes de equipe e não-líderes. O método para análise dos dados são critérios quantitativos, quantitativos e estatísticos;

III - O estudo proposto poderá trazer riscos mínimos, visto que pode trazer constrangimento ou desconforto durante a coleta de informações, além do tempo disponibilizado para o mesmo. Visando minimizar os riscos da pesquisa, se for por meio de questionário será respondido de forma remota, via Google Forms, onde a(o) voluntária(o) poderá participar no local e horário que se sentir mais confortável. Os benefícios da pesquisa podem ser vistos através de três perspectivas: (i) da ótica organizacional, refere-se aos processos ágeis mais eficazes (com foco na liderança) utilizados pelas empresas de desenvolvimento para favorecer o desenvolvimento de produtos e/ou serviços de forma satisfatória para os usuários, podendo gerar menor custo financeiro e maior competitividade; (ii) do ponto de vista da profissão, pode-se ter uma melhoria no processo

de liderança, vindo à maximizar o desenvolvimento de *soft skills* em todos os membros da equipe e a capacidade de tomada de decisão de forma dinâmica, como também a qualidade e entrega dos serviços, minimizando problemas práticos que podem surgir no decorrer do processo ágil; (iii) do ponto de vista científico, a pesquisa contribuirá para um melhor entendimento sobre a liderança ágil de forma efetiva nas empresas de software, embasando pesquisas futuras sobre o tema, tendo em vista que ainda é um tema pouco explorado na área sobre aspectos humanos em Engenharia de Software, principalmente no que diz respeito a visão de não-líderes que, em processos ágeis, também exerce atividades de liderança;

IV - Você tem a liberdade de, a qualquer momento que desejar, entrar em contato para obter informações sobre esta pesquisa, sobre a sua participação ou outros assuntos relacionados à mesma através do contato com a pesquisadora, pelo telefone: (83) 98773-2333 e através do e-mail: narallynne@copin.ufcg.edu.br.

V - Você tem a liberdade de desistir ou de interromper a sua colaboração neste estudo quando desejar, sem necessidade de qualquer explicação;

VI - Os dados obtidos por meio desta pesquisa serão **confidenciais e não serão divulgados em nível individual**, visando assegurar o sigilo e a privacidade dos participantes durante todas as fases da pesquisa:

a) Em relação ao uso das informações pessoais, fica garantido que:

(i) Os dados serão usados unicamente para fins científicos;

(ii) Em nenhum momento da pesquisa será necessário informar nome ou qualquer informação que identifique a(o) voluntária(o);

(iii) A(o) participante tem a liberdade para desistir de permitir o acesso às suas informações prestadas a qualquer momento, sem ser penalizada(o) fisicamente, financeiramente e moralmente;

(iv) Ao final da pesquisa, se for do interesse de ambas as partes, a(o) participante terá livre acesso ao conteúdo da mesma, podendo discutir os dados com a pesquisadora.

VII - Os resultados obtidos durante esta pesquisa serão mantidos em sigilo, mas, ao participar, você concorda que sejam divulgados em publicações científicas, uma vez que garantimos que seus dados pessoais jamais serão mencionados;

VIII - Após a pesquisa, poderemos entrar em contato com você novamente, por e-mail, seja para confirmar algumas informações solicitadas durante a coleta de dados, ou mesmo para obter novas informações.

IX - Caso se sinta prejudicada(o) por participar desta pesquisa, poderá recorrer ao Comitê de Ética em Pesquisas com Seres Humanos – CEP, do Hospital Universitário Alcides Carneiro - HUAC, situado a Rua: Dr. Carlos Chagas, s/ n, São José, CEP: 58401 – 490, Campina Grande-PB, Tel: 2101 – 5545, e-mail: cep@huac.ufcg.edu.br; Conselho Regional de Medicina da Paraíba e a Delegacia Regional de Campina Grande.

Ao aceitar, você concorda de livre e espontânea vontade em participar como voluntária(o) do estudo de avaliação sobre atividades de liderança em equipes ágeis de desenvolvimento de software e declara que obteve todas as informações necessárias, bem como todos os eventuais esclarecimentos quanto às dúvidas por você apresentadas.

*Campina Grande/PB,
2024.*

D.2 Consent of the Ethics Committee - in portuguese

UFCG - HOSPITAL
UNIVERSITÁRIO ALCIDES
CARNEIRO DA UNIVERSIDADE
FEDERAL DE CAMPINA
GRANDE / HUAC - UFCG



Continuação do Parecer: 5.839.089

Ausência	TCLE.pdf	17/11/2022 11:00:33	Narallynne Araújo	Aceito
Declaração de Pesquisadores	TermoDeCompromissoPesquisador.pdf	17/11/2022 11:00:18	Narallynne Araújo	Aceito
Folha de Rosto	folhaDeRosto_assinado.pdf	17/11/2022 08:50:02	Narallynne Araújo	Aceito

Situação do Parecer:

Aprovado

Necessita Apreciação da CONEP:

Não

CAMPINA GRANDE, 26 de Dezembro de 2022

Assinado por:

Andréia Oliveira Barros Sousa
(Coordenador(a))

Endereço: CAESE - Rua Dr. Chateaubriand, s/n.

Bairro: São José

CEP: 58.107-670

UF: PB

Município: CAMPINA GRANDE

Telefone: (83)2101-5545

Fax: (83)2101-5523

E-mail: cep@huac.ufcg.edu.br