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Optimizing Agile Project Management in the Global Telecommunications Industry: A Consulting Report on Scaling Agile Frameworks for Cross-Border 5G and Cloud Infrastructure Projects

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Abstract

The global telecommunications industry is undergoing profound transformation, through 5G, cloud computing, and, virtualized infrastructure, requiring organizations to, deliver complex cross-border projects, with greater speed and adaptability. Traditional project management methods, have proven inadequate, for, managing the scale, uncertainty, and regulatory diversity of such environments. This research examines, how hybrid scaled agile frameworks, combining agile flexibility with, structured governance, can, optimize project delivery across multinational telecom programs. Adopting a mixed-methods approach, the study integrates, a systematic literature review, with quantitative survey analysis, of practitioners across global telecom firms. Findings show that, hybrid models, such as tailored versions of SAFe, LeSS, and, the Spotify model, enhance coordination, transparency, and stakeholder satisfaction while mitigating compliance and cultural barriers. However, success depends on leadership commitment, coherent governance structures, and, continuous learning mechanisms. The study contributes empirically, to the limited body of research, on agile scaling, in telecommunications, and proposes a practical framework, for adapting hybrid agile practices, to global, regulated, and distributed project environments. Its recommendations aim, to guide executives, and, project leaders, in achieving agility, without compromising control, thus, supporting sustainable digital transformation, in the telecommunications sector.

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CHAPTER 1: INTRODUCTION

1. Introduction to the chapter

In the era of pervasive digital transformation, telecommunications companies are facing, immense pressure, to deliver, new services faster, adapted to shifting customer demands, and, coordinate global infrastructure projects. Particularly, with 5G rollouts, edge computing, virtualization, and, cloud-native architectures, telecom operators undertake large-scale, multi-national programs spanning hardware, software, network, and, regulatory domains. Traditional project management approaches, predominantly, waterfall or stage-gate models, are, increasingly inadequate to, coordinate change, across such, complexity and speed. To address this, many organizations, are turning to agile, and, scaled agile methodologies. Yet, in regulated, multi-vendor, cross-border environments, purely agile models, often, clash with governance, compliance, and, coordination demands. The result, is a rise in hybrid scaled agile practices, blends of agile, with structured, project controls. This chapter, lays the foundation, for the research by: situating the study, in the telecom and, agile evolution context; stating the core problem; justifying the research; presenting, the aim, objectives, as well as research questions; describing the significance, limitations, and, scope; and finally, summarizing the chapter and transitioning to the literature review.

1.1 Background and context

1.1.1 Telecom Industry Transformation and Digital Pressures

Telecom firms globally are undergoing rapid transformation as networks evolve toward 5G, software-defined networking (SDN), and network functions virtualization (NFV). Operators are shifting from static infrastructure to dynamic, software-driven systems, demanding agility in operations, development, and project coordination (PwC, 2025). Varzazu and Bocean (2024), identified that, the competitive environment, with cloud providers, over-the-top services, and digital ecosystems, further forces telecom companies to reduce time-to-market, experiment with new services, and reconfigure legacy processes.

This industrial pivot, requires, project models, that, are, capable of, accommodating uncertainty, cross-domain integration, along with, incremental delivery across countries. Traditional project management approaches, designed for, linear progression as well as, limited feedback loops, struggles to, cope with, these demands (Shehadeh et al., 2023). In response, many telecom organizations, are exploring agile, and, scaled agile frameworks, to support iterative, adaptive execution, across large programs, and, geographically distributed teams.

1.1.2 From Team-level Agile to Scaled and Hybrid Models

Agile methodologies, (e.g., Scrum, Kanban), originated, in small software teams, to manage volatility, enable continuous feedback, and, emphasize customer collaboration. However, as organizations, sought to scale agile, to multiple teams or programs, scaled agile frameworks (such as SAFe, LeSS, Nexus, and Spotify's tribe/chapters model), emerged, to coordinate alignment, dependencies, and, portfolio-level governance (Carroll et al., 2023).

Even then, pure agile scaling, often, conflicted, with enterprise requirements around risk, regulatory compliance, vendor contracts, and, hierarchical oversight. Hence, many organizations

adopt hybrid scaling strategies, combining agile practices with traditional project controls, risk management, along with, governance. In a recent systematic review, Almeida and Bálint (2024) analyzed, 38 studies of hybrid scaling, and, showed that, hybrid scaling is often implemented via ambidextrous strategies, balancing, agile with traditional project management practices. They also observed, that, most empirical studies, in this domain, date from 2021 onward, and, that, qualitative, or case-report methodologies dominate (Almeida & Bálint, 2024).

The hybrid paradigm, permits, organizations to, retain, formal oversight, whilst enabling, agility at the execution level (Tettey et al., 2025). For example, the hybrid approach may, maintain, senior approval gates, architectural reviews, or regulatory compliance steps, whilst, enabling teams, to operate in agile sprints, or increments. This creates a tension between adaptability and predictability, which must be managed carefully.

1.1.3 Scale, Coordination, and Globalization Challenges in Telecom

Implementing, agile at scale, in a telecom context, introduces, unique challenges. First, the size and, complexity of infrastructure projects, multi-vendor ecosystems, and, regulatory diversity make dependency management, and, cross-team coordination, more difficult. Second, geographic spread, often spanning multiple countries, cultures, and, time zones, exacerbates communication, alignment, and knowledge-sharing issues.

Tobisch and Matthes (2025), show that, knowledge sharing, and, coordination, in large-scale agile efforts, often, suffer from misalignment, insufficient communication, and, location dispersion; organizations use roles, meetings, tools, artifacts, and, Communities of Practice, to mitigate these. Third, compliance, security, and audit requirements in telecom, often demand traceability, documentation, and, formal oversight, elements, that, can conflict with, agile's lightweight principles. Integration of compliance elements (e.g., security, regulatory) with agile processes is nontrivial (Moyón et al., 2021). Finally, as organizations grow in size, the "dark side" of agility emerges: innovation depletion, coordination burden, and, cultural resistance (Annosi et al., 2024).

Recently, Aydın et al. (2025), examined, hybrid agile project management, in a telecommunications firm. Based on qualitative interviews with PMO, Agile Coaches, Scrum Masters, and, business leadership, they found, that, hybrid models help balance regulatory demands, risk management, and, agility. They describe distinct roles, such as, Analyst Phase Leader, and, Development Phase Leader, to mediate agile, and, traditional processes (Aydın et al., 2025). However, the authors note that, as, organizational scale increases, satisfaction with agile tends to decline, showing, the friction inherent in large, complex environments.

Another, interesting domain-specific insight, comes, from Ericsson: in Ericsson's development units, within telecom, hybrid work, and, agile practices, must be adapted. For example, in hybrid work settings, some meetings, requiring rich discussions (retrospectives, technical discussions), benefit from, face-to-face presence, while, larger, information-sharing sessions, function well remotely (Christensen et al., 2025). This indicates that, even, meeting design decisions, must be rethought, in scaling agile, in telecom contexts.

Furthermore, a case study of a U.S. telecom, firm collaborating with, NTT Data, demonstrates that, scaling agile, reduced, time-to-market, from 2.5 years, to, under six months, cut costs, and, improved, transparency, and, collaboration. The transition, was done, via incremental

introduction, of Agile Release Trains (ARTs), breaking down silos, and, establishing, center-of-excellence capabilities (NTT Data case, 2025).

Although, there are promising practices, the empirical literature, on scaled hybrid agile, in multinational telecom projects, especially, cross-border programs, with regulatory, cultural, and, technical complexity, remains thin. There still has been observed, a lack of a deep, understanding of, which hybrid practices work best, what, challenges persist, and, how to tailor, agile frameworks, to global telecom program environments.

1.2 Problem statement

Telecom operators, are, increasingly adopting, scaled agile, and, hybrid models, to keep pace with market demands, yet, face substantial obstacles, in aligning agility, with governance, regulatory compliance, and, cross-border coordination. The fundamental challenge, is: how to scale, agile practices, across multiple geographies, vendors, and, regulatory domains, while, achieving speed, quality, and, stakeholder satisfaction.

Key manifestations of the problem include:

1. **Coordination and alignment across distributed teams:** As scaled agile reaches across regions and functions, dependencies, misalignment, and inconsistent practices proliferate (Sońta-Drączkowska et al., 2025).
2. **Cultural resistance and organizational inertia:** Larger enterprises often struggle with existing silos, hierarchical mindsets, and resistance to agile transformation (Carroll et al., 2023).
3. **Governance, compliance, and risk conflict:** Telecom projects, are, subject to, heavy regulation, security audit, vendor contract obligations, and, performance guarantees. Pure agile models, often lack, mechanisms for, formal documentation, traceability, or formal approvals. Integrating, these demands, without undermining agility, is nontrivial (Moyón et al., 2021).
4. **Measuring success consistently:** Organizations often, default to, metrics, such as speed or, delivery volume, without adequately measuring quality, stakeholder satisfaction, or compliance adherence.
5. **Fragmented prior research:** Much academic research, on agile scaling, is confined to software, or single-country contexts, lacking the global telecom perspective. An empirical study, in multinational telecom settings, is absent.

Therefore, the core research problem is: despite, the growing adoption of, hybrid scaled agile, in telecom transformations, there, is insufficient empirical evidence, on how to, tailor, and, optimize hybrid scaling methods, for global, large-scale telecom projects, to, deliver efficient, high-quality, stakeholder-aligned outcomes.

1.3 Research rationale

1.3.1 Practical Rationale

Telecom operators, globally, are making massive investments in 5G, cloud, and, digital infrastructure transformations. Even, minor inefficiencies, or coordination breakdowns, can, lead to delays, cost overruns, and, reputational damages. An empirical understanding, of, how hybrid scaled agile practices, function, in real multi-national contexts, can, help practitioners to, mitigate risks, accelerate delivery, and, improve stakeholder satisfaction. This research aims to extract, actionable patterns, mitigation strategies, and, adaptation guidelines, that, telecom executives, program managers, and, agile coaches can apply, especially for cross-border projects, where governance, cultural, and, regulatory challenges, are still at large.

1.3.2 Academic Rationale

While the body of literature, on scaled agile, and, hybrid methods, has, expanded in recent years, empirical studies remain limited, especially, in telecom or, infrastructure domains. Moreover, most studies, are, descriptive case reports, rather, than comparative, multi-site investigations. This work intends to, contribute, to the fields of project management, organizational agility, and, global operations, by, offering empirical insights, into hybrid scaling in telecom. In particular, it bridges, a gap between, theoretical agile frameworks, and, real-world constraints, in global programs.

1.3.3 Strategic and Industry Significance

Given the urgency of, digital transformation, and, competitive pressures, telecom operators, need frameworks, that, combine agility, with, disciplined governance. Insights from this research, can, influence industry best practices, guide center-of-excellence design, and, shape standards, for hybrid scaling in regulated, large-scale environments.

1.4 Aim and objectives

1. To review the recent literature on current and emerging scaled hybrid agile practices in leading multinational telecom projects in telecom companies.
2. To identify the commonly faced obstacles by organizations, when implementing scaled hybrid agile practices, as well as, to identify the solutions for mitigation of those issues.
3. To assess the impact of scaled hybrid agile frameworks on project outcomes such as, delivery speed, quality, and stakeholder satisfaction.
4. To propose recommendations for tailoring currently applied and emerging, hybrid scaled agile frameworks, to global telecom project requirements for improved outcomes.

1.5 Research questions

1. How are scaled agile frameworks currently applied in multinational telecom projects, and what hybrid practices are emerging?
2. What challenges do organisations face in scaling agile across borders, and how are these mitigated?
3. What are the impacts of scaling agile on delivery speed, quality, and stakeholder satisfaction?

4. How can agile frameworks be tailored for global telecom projects to improve outcomes?

1.6 Significance of the research

The significance of this research, lies, in its contribution, to, both academic theory, as well as, practical application, within, a sector, undergoing, one of the most, complex digital transformations, of the twenty-first century. Although, agile, and, hybrid project management, have been extensively discussed, in software engineering, there remains, a paucity of research, examining, how, these approaches operate, in large-scale, multinational telecommunication, environments, where, the interplay, between, regulation, technology, and, culture, creates unique challenges. This study therefore addresses, an, important empirical, and, conceptual gap: how hybrid scaled agile frameworks, can be effectively, adapted for global telecom projects, to deliver, improved speed, quality, and, stakeholder satisfaction, without, compromising governance, or, compliance. By interrogating this gap, through evidence, from cross-border telecom programmes, the research, establishes, a bridge, between, agile theory, and, the realities of, enterprise-level implementation.

From an academic perspective, this study, extends, the boundaries of, agile, and, project management theory, by examining, the application of, hybrid scaling, within the under-explored domain, of multinational telecommunications. Current literature, tends to treat, scaled agile as a uniform methodology, often, far-setted, from industry-specific complexities (Carroll et al., 2023; Almeida & Bálint, 2024). In contrast, this research, situates, hybrid scaling, within an environment, characterised by, regulatory heterogeneity, multi-vendor collaboration, and, global governance structures. It contributes to the, discourse on ambidexterity, the organisational capacity to balance, flexibility and, control, by offering empirical insights, into how, telecom operators navigate, these tensions. Moreover, it proposes, a conceptual model of, hybrid scaling tailored, to global telecom contexts, thereby, enriching the theoretical basis, upon which, future comparative, or, longitudinal studies can be build.

For practitioners, the study offers, tangible benefits, by offering, an evidence-based guidance, for project managers, PMOs, and, agile coaches, who operate within, complex multinational ecosystems. By identifying recurring barriers, such as, coordination inefficiencies, rework, and, misalignment, between agile teams, and, governance layers, it provides, strategies to mitigate friction between, adaptive practices, and, compliance requirements (Aydin et al., 2025). The findings, will assist, in designing, more coherent transformation roadmaps, and, centres of excellence, capable of, sustaining agile performance, beyond pilot initiatives. Ultimately, it aims to enhance managerial decision-making, by, translating theoretical constructs, into actionable frameworks.

At the strategic level, the research holds importance for the telecom industry as a whole. As 5G and cloud infrastructure programmes increasingly rely on multinational coordination, the ability to institutionalise scalable yet flexible delivery models become a source of competitive advantage. The study's outcomes could inform the standardisation of hybrid scaled agile practices, influencing industry bodies and cross-operator collaborations. More broadly, it supports the development of resilient and responsive organisational architectures that, reconcile agility with regulatory accountability, an imperative for telecom operators seeking sustained innovation and operational excellence in an era of global digital interdependence.

Despite the growing body of literature on agile and hybrid project management, several critical research gaps remain unaddressed. First, there exists an *empirical gap* concerning how hybrid scaled agile frameworks are applied within multinational telecom environments, where cross-border collaboration, regulatory diversity, and cultural heterogeneity create unique implementation challenges. Most existing studies are confined to single-country or software-only contexts, limiting the external validity of their conclusions (Carroll et al., 2023; Aydın et al., 2025). Second, a *theoretical gap* persists in the limited integration of organizational ambidexterity theory, the balance between exploration and exploitation, with scaled agile frameworks. Although ambidexterity is conceptually aligned with hybrid agility, it has seldom been operationalised in empirical telecom studies (Almeida & Bálint, 2024). Third, there is a *methodological gap* stemming from the scarcity of mixed-method approaches that, combine quantitative measurement of delivery performance with qualitative exploration of organisational behaviour and stakeholder perception. This absence constrains the development of robust, evidence-based models that, reflect both process efficiency and human dynamics. Addressing these three interrelated gaps positions this study to make a substantive contribution to both theory and practice in global telecom project management.

1.6.1 Limitations of the study

While this study aims to make a substantive contribution to the understanding of hybrid scaled agile practices in multinational telecommunications projects, several limitations must be acknowledged to contextualise its scope and findings.

Firstly, the research is geographically and sectorally bounded, focusing predominantly on large multinational telecom operators within the Eurasian and European regions. This geographic delimitation is necessary for feasibility and comparability but may constrain the generalisability of results to other sectors or non-Western markets, where organisational culture, regulatory regimes, and resource availability differ significantly (Tobisch & Matthes, 2025). Consequently, while the findings may provide transferable insights, they cannot claim universal applicability.

Secondly, the study relies on a mixed-methods design combining survey and literature based data, which introduces potential challenges related to sampling bias and respondent subjectivity. Survey participation often attracts practitioners with a vested interest or positive bias toward agile adoption, while literature based data, may reflect managerial perspectives rather than those of operational staff (Carroll et al., 2023). Although triangulation and anonymisation will be employed to mitigate such bias, it cannot be fully eliminated.

Thirdly, given that, agile frameworks and telecom technologies evolve rapidly, the study captures practices within a specific temporal context (2019–2025). The dynamic nature of 5G deployments, regulatory changes, and the continuous evolution of agile frameworks such as SAFe and LeSS may render some observations time-bound (Aydın et al., 2025).

Finally, the study's focus on project management and process-level outcomes, such as delivery speed, quality, and stakeholder satisfaction, means that, financial performance or long-term strategic impacts fall outside its scope. Nonetheless, acknowledging these limitations enhances the study's transparency and provides a realistic boundary for interpretation, ensuring that, conclusions are drawn within an appropriately delimited empirical and conceptual framework.

1.6.2 Scope of the study

The scope of this study has been carefully delineated to ensure that, its findings remain relevant, coherent, and methodologically rigorous within the complex landscape of multinational telecommunications. The research concentrates on large-scale 5G, cloud infrastructure, and digital transformation projects conducted by multinational telecom operators and technology integrators, such as Vodafone, Ericsson, Nokia, and Huawei, which operate across multiple regulatory and cultural contexts. By narrowing the scope to these global projects, the study focuses on environments where the challenges of coordination, compliance, and cultural diversity are most pronounced, providing an appropriate testing ground for evaluating the effectiveness of scaled hybrid agile frameworks.

The investigation is limited to project and programme management processes, particularly the implementation and adaptation of scaled agile methodologies, such as SAgile, LeSS, and the Spotify model, and their integration with traditional governance mechanisms. The study evaluates outcomes along three core dimensions: delivery speed, output quality, and stakeholder satisfaction. These dimensions are selected because they represent critical indicators of performance and competitiveness in telecom transformation programmes (Aydın et al., 2025).

While the study acknowledges that, agile transformations can have financial, strategic, and organizational implications, financial performance metrics and long-term strategic outcomes fall outside its direct analytical remit. Similarly, purely software-based agile teams and single-country projects are excluded, as they lack the cross-border complexity central to this research.

The study's timeframe encompasses the period between 2019 and 2025, reflecting a phase of accelerated 5G rollout and widespread enterprise adoption of scaled agile practices (Carroll et al., 2023). This temporal boundary captures the post-pandemic shift toward hybrid working models and the consolidation of agile scaling as a mainstream enterprise approach in telecommunications.

By defining these parameters, the research maintains conceptual clarity while enabling a deep, contextually grounded exploration of how hybrid agile frameworks function under the constraints of global telecom operations. The resulting insights are intended to guide both theoretical development and managerial practice in similar large-scale, regulated, and distributed environments.

1.7 Chapter summary

This chapter introduced the study by outlining how the global telecommunications industry is evolving through large-scale digital and agile transformations. It presented the background, problem statement, rationale, and the central aim and objectives that, guide the research. The discussion highlighted why exploring hybrid scaled agile frameworks in multinational telecom projects is both timely and necessary, noting the current gaps in evidence, theory, and methodology. It also clarified the study's scope and limitations, ensuring transparency about what the research will and will not address. Overall, this chapter has laid the conceptual groundwork for the investigation. The next chapter turns to existing academic and industry literature to examine how agile and hybrid project management practices have developed, and where further inquiry is needed.

CHAPTER 2: SYSTEMATIC REVIEW OF LITERATURE

2. Introduction to the chapter

The chapter, will evaluate, the selected studies, via PRISMA methodology for a, systematic review, of the collected literature, which, will later on, form the basis of, the, qualitative strand of, the mixed methods study design. In this chapter, we will, look into the application, modification, as well as, the maintenance of, scaled agile frameworks, including Scaled Agile, Inc. SAFe, LeSS Company B.V. LeSS, and, the Spotify model, to the global telecommunication organizations, which have evolved, due to, the 5G and, cloud transformation.

The core aim, of this systematic literature review (SLR), is to, scan the, operationalisation of these frameworks, in complex, distributed environments, in order to, understand, how they are hybridised, with current governance policies, delivery frameworks, along with, the, consequences, and, difficulties of their application. With the shift of multinational telecommunications organisations, increasingly towards, change based on, the cloud-native, and, 5G, the dynamics of agile scaling, in this field is not only theoretically salient, but also practically pressurizing. The review, adheres to, PRISMA 2020 method, to guarantee that, the methodology remains stringently, systematic and, transparency.

2.1 PRISMA Protocol

PRISMA (2020), is a systematic protocol, of identification, screening, appraisal, as well as, synthesis of, relevant research, which involves, collection and in-depth analysis of a large body of literature based data. Through the application of PRISMA, the review, does, not only guarantee, reproducibility, but also shows, to having been extracted via, a clear audit trail of, search strategy, up to final inclusion, and, synthesis (Page et al., 2021). This systematic method is especially suitable, when, the literature is, disjointed in terms of technical, organisational, and, project management aspects (Albhirat et al., 2024). Even though the theory of agile scaling has been well-documented, in, both, software engineering, and, overall IT domains, there is a lack of empirical studies, on multinational telecom and, 5G-cloud settings.

The majority of, the available research, is devoted to, the, principle of generic scaling, whereas, much less attention, is paid to sector-specific regulatory, infrastructural, as well as, operational challenges, that, determine agile adaptation in telecom. A successful resolution, to this gap, offers a, useful source of evidence to, academic research, and, practice in the industry. The chapter is structured, in the following way: the initial sections include, the, PRISMA protocol, followed by its specifications such as inclusion exclusion criteria, selection strategy, and, data collection in subsequent sections. Which will then, be followed by a very detailed overview of each included study, followed by limitations of the SLR and chapter summary

2.2 Systematic Literature Review

A Systematic Literature Review (SLR) is a methodical, transparent, as well as, reproducible method of identifying, assessing, whilst integrating, current literature, on a given subject. An SLR, in contrast to a traditional narrative review, which can be selective, or, interpretive, adheres to a protocol, to reduce bias, and guarantee, that, the literature is well covered (Mengist et al., 2020).

This shows that, SLR, is especially appropriate, with regards to, the research areas, that, are rapidly changing, and, in which, the conceptual clarity is still in development phase (Carrera-Rivera et al., 2022). Within the framework of the present dissertation, that, explores the application of scaled agile frameworks, into multinational projects, in the telecommunications industry, an SLR can, provide a strict framework of, mapping the state of knowledge, uncover thematic patterns, whilst, revealing gaps, in the available existing empirical evidence, that, needs to be filled, in the further stages of the empirical process.

This dissertation will be based on the, PRISMA (2020) (Preferred Reporting Items to systematic Reviews and Meta-Analyses) as a methodology. PRISMA, offers an established methodology, to perform a clear review, a clear description of search strategies, inclusion / exclusion criteria, as well as screening procedures. Its focus, on documentation, and, reproducibility, prevents the auditing or replication, of the review in future studies. It is especially useful in the agile, and, telecommunications sectors, whereby, with fast technology, and, organisational progression, ad hoc reviews may soon be rendered unnecessary (Shinde et al., 2025). The use of an SLR approach, can, also be explained, by the fact that, the existing studies of agile scaling in telecom, are, dispersed across various fields, such as project management, software engineering, as well as, network transformation, and, is reported both research, and industrial publications. The review will form a solid evidence base, to, examine the manner in which, frameworks like Scaled Agile, Inc. SAFe, LeSS Company B.V. LeSS, and, the Spotify model, had been, adapted to, the particular regulatory, technical, and organisational aspects of, multinational telecom settings, by, the systematic search, and, review of the existing, pertinent studies (2019-2025). This systematic approach, provides internal validity, as well as, practical applicability of the research findings, in the dissertation.

2.2 Review protocol and search strategy

2.2.1 Introduction to the screening process and overview of methodology

This review followed, a structured, and, transparent protocol, aligned with the PRISMA (2020), guidelines, ensuring reproducibility, and, clarity, in how studies had been identified, screened, selected, and analysed. The protocol is fully documented the appendices as follows: Appendix A, which includes the coding scheme of exclusion criteria (C1–C6), applied to the exclusion decisions. This is followed by, the PRISMA screening flow diagram in Appendix B, the overview of study characteristics post-first screening in Appendix C, the included studies after second screening in Appendix D, the excluded studies after second screening in Appendix E, the CASP checklist used for assessment of, qualitative studies, in Appendix F, and, the MMAT checklist, used for assessment of, mixed methods or quantitative studies, in Appendix G.

2.2.2 Dual screening process

The choice to adopt, a two-stage reading process, had been driven by the need for both, breadth through keyword, and abstract based screening, as well as, the depth, through full-text assessment (Waffenschmidt et al., 2019), in a field where, literature remains scattered, across agile, software engineering, telecommunications, along with, cloud transformation research.

(a) First stage screening process: title and abstract based reading

In the first stage, a broad database search was conducted, across Scopus, Web of Science, IEEE Xplore, ACM Digital Library, and, MDPI. Search terms included combinations of “scaled agile”, “SAFe”, “LeSS”, “Spotify model”, “hybrid agile”, “telecommunications”, “5G”, “cloud transformation”, and “global or multinational projects”. The date range timeline, had been set, from 2019 to 2025, only English-language articles had been included, and, preference had been, given to, open-access sources, to ensure full-text availability.

Identified records had been exported to, a reference manager, duplicates had been removed, and, titles plus abstracts underwent screening. At this stage, inclusion criteria, such as peer-review status, agile scaling references, multinational or large-scale context, as well as, telecom or closely related settings, had been applied as well. Exclusion criteria, such as small team focus, purely technical network architecture, or non-agile project management methods, had been also enforced as parameters of exclusion. Articles meeting these conditions, had been moved forward to full-text review.

(b) Second stage screening process: full text review

In the second stage, the full texts, of shortlisted articles, had been read in detail. A more rigorous set of inclusion, and, exclusion criteria, had been applied (Table 1). The assessment had, considered the context, including, telecommunications and, multinational relevance, the scaling framework used (e.g., SAFe, LeSS, hybrid), outcomes reported (e.g., performance, adaptation, challenges), along with, the type of empirical evidence, which had been presented (qualitative or quantitative). Based on these assessments, as well as, using the coding scheme (C1–C6), defined in Appendix A, final articles had been, selected for detailed overview, and, had been mapped into Appendices, C (first reading overview), D (included articles), and, E (excluded articles, with reasons). The screening flow diagram, conforming to, the PRISMA template, had also been designed for new reviews (Appendix B). The search strategy adopted for this purpose, is summarised in the table 1 below:

Table 1: Systematic review of literature: Dual staged screening and search protocol

Stage	Activity	Databases & Sources	Key Search Keywords / Phrases	Inclusion Criteria	Exclusion Criteria
Identification	Initial broad search	Scopus; Web of Science; IEEE Xplore; ACM Digital Library; MDPI; additionally conference proceedings/industry white-papers	“scaled agile” OR “SAFe” OR “LeSS” OR “Spotify model” AND “telecommunications” OR “telecom” OR “5G” OR “cloud transformation” AND (“multinational” OR “global” OR “vendor ecosystem”)	English language; published 2019-2025; peer-reviewed OR industry study; open access preferred	Before 2019; non-English; documents without full-text availability; irrelevant domain (e.g., only network hardware)
Stage 1 Title/Abstract Screening	Screen titles and abstracts	Same databases (records after deduplication)	“scaled agile” OR “SAFe” OR “LeSS” OR “Spotify model” AND “telecommunications” OR “telecom” OR “5G” OR “cloud transformation” AND (“multinational” OR	Mention of agile scaling framework; large/multinational context; telecom/5G/cloud context	Small team only; purely network-architecture or hardware focused; non-agile project management method only

	“global” OR “vendor ecosystem”)			
Stage 2 Full-text Screening	Read full text for deeper eligibility	Full-text articles retrieved	-	Context: telecom or multinational vendor ecosystem; framework explicitly discussed (SAFe/LeSS/hybrid); empirical data (qualitative/quantitative) Wrong context (pure software without telecom/vendor context); no clear discussion of scaling; no empirical evidence
Included Studies	Final selection	,	,	Studies meeting all criteria from Stage 2

Source: Own results

2.2.3: Exclusion criteria for coding application

A structured exclusion process, had been applied, to, ensure that, only studies directly relevant to, agile scaling frameworks within, the, telecommunications sector, had been, included in the review, as explained by Anifa et al., (2024). The primary objective, of the SLR, had been, to focus on organizational, and, project-level agile transformation, rather than, general telecom technologies, or, conceptual discussions. A total of five articles had been excluded, after full-text screening, due to lack of alignment, with the inclusion focus, on agile scaling frameworks in telecommunications.

As summarized in Appendix D, three studies either, lacked applied agile framework implementation, or, remained purely conceptual. Two studies, had been excluded, as they had been, entirely technical, focusing on 5G network infrastructure, and, security without any organizational, or, project management perspective. None of the excluded studies, provided sufficient empirical data, or, framework application, relevant to agile scaling, in telecom contexts. Exclusion criteria had been, consistently applied, using a structured coding system, (C1–C6, Appendix A), to ensure methodological transparency, and, reproducibility. Articles had been excluded, if, they met one or more of the following criteria:

1.

Lack of Agile framework application: Studies that, did not reference, apply, or, evaluate agile frameworks (e.g., SAFe, LeSS, Scrum at Scale, Spotify, hybrid agile) in, a telecom-related context.
2.

No relevance to scaling or transformation: Articles focusing on, 5G, IoT, or, other telecom technologies, without, organizational transformation, scaling agile methods, or, project delivery implications.
3.

Conceptual or narrative nature: Papers that, had been, purely conceptual, theoretical, or, descriptive, with no empirical data, case study, framework analysis, or, implementation methodology.
4.

Technical architecture-based studies: Articles centred on, network architecture, protocols, security models, or, Open RAN technical evolution, without, agile project management or, framework relevance.

5. **Misaligned sector or context:** Research conducted in, adjacent industries, or, contexts that, could not be meaningfully transferred, to, telecom agile scaling scenarios.
6. **Insufficient Methodological Detail:** Articles lacking clarity, in research design, methodology, or, data, thereby limiting the ability to, extract relevant information, for the inclusion criteria matrix.

2.3 Data Extraction

Following the two-stage screening process, the data extraction phase, had been initiated, to systematically record, key information, from each of the nine core articles, that, passed full-text eligibility. In line with the reporting guidance of the PRISMA (2020), guidelines, which emphasise transparent data collection, and, predefined variables, an extraction template, had been developed, and, piloted on a small subset, of three studies, to ensure clarity, and, consistency. The full extraction process, had been outlined in Appendix B, and, the extracted information had been presented, in the following section, as an overview, which will, then form, the subsequent thematic synthesis.

Each selected study, had been processed, through the extraction template, which contained dimensions (Appendix C), based on, scaled-agile frameworks, within multinational telecommunications environments. These included, firstly, the bibliographic details (authors, year, journal or source, country or region) had been recorded, to allow traceability (Klarin, 2024), as well as, cross-study indexing. Secondly, the study characteristic dimensions, had been, recorded such as, research design (empirical, conceptual, mixed-methods), organisational context (telecom operator, vendor, or hybrid), and, project scope (national, multinational, global) (Shaheen et al., 2023). This extraction had, aligned with established guidance, on systematic review extraction, highlighting the importance of consistent coding, to enable comparability.

The third dimension, included, the framework, and, scaling context, which scaled-agile framework (for example, Scaled Agile, Inc. SAFe, LeSS Company B.V. LeSS, Spotify model, or custom hybrid) had been, applied, as well as, the level of scaling (team, programme, portfolio), and, any reported tailoring, or hybridisation (Schreiber and Crammer, 2022). This focus allowed, the review to stay closely aligned, with the research questions, regarding how frameworks, had been adapted, in multinational telecom settings. A fourth dimension, i.e., contextual and, environmental factors, showed variables relevant to, telecom and, 5G-cloud settings (Camara and Marinho, 2024): regulatory or compliance constraints, hardware–software integration, distributed teams, multi-vendor supply chains, along with, cloud infrastructure dependencies. This further included, domain-specific factors, which had reflected, rigorous detailed protocol, that, extraction frameworks, should be tailored, to the review context, rather than relying on, generic templates alone (Booth et al., 2019).

Finally, the fifth dimension, reported outcomes, challenges, and, enablers, recorded major findings from each study, including delivery speed, quality improvements, stakeholder satisfaction, governance integration issues, cultural barriers, along with, risk mitigation strategies (Zaccagnini and Li, 2023). In addition, a quality appraisal field, had been, incorporated, using the Mixed Methods Appraisal Tool for, mixed-methods studies or quantitative studies (Hong et al., 2019), or the Critical Appraisal Skills Programme tool, for qualitative research (Galdas et al., 2015; Long et al., 2020). This ensured that, extracted data remained linked, to, methodological strength.

This practice reflected, accepted methodological standards, which recommend that, extraction forms be piloted, clearly coded, whilst being, applied, by two reviewers, to minimise error rates (Butcher et al., 2020). All extracted data, from the nine studies, had been compiled into the matrix, in Appendix C, providing a solid evidential base, for, the thematic analysis, in the next chapter. By linking extraction, to a structured template, and, documenting the procedure transparently, this section ensured, the review remained reproducible, auditable, and, consistent with best-practice standards, for systematic literature reviews (Afifi et al., 2023).

2.4 Overview of included studies

Following the completion of the full-text screening, nine studies had been selected for the review. These studies had been, summarised, in the “Included Studies” table in Appendix D. Together, these studies present, a, cohesive body of work, that, while differing in methods and, scope, share, a clear thematic focus, on scaling and, applying agile approaches in large, complex, and, distributed settings. Differences in research design, context, framework implementation, as well as, sectoral emphasis, provide, a more deeply integrated, view, of how agile practices, develop, and, function across multinational telecommunications, as well as closely related fields.

With regard, to research design, the selected works, span a wide range, including empirical case studies, mixed-method research, qualitative literature analysis, and, conceptual or analytical frameworks. This variety enables, the review, to draw on both in-depth contextual insights, along with, more structured, measurable results. Such a combination, is particularly valuable, in a field where, organisational structures, technological environments, and, regulatory conditions, vary widely. The inclusion of mixed-method, and, qualitative studies, also reflects, broader trends identified, in recent systematic reviews of agile scaling. For instance, Almeida and Bálint (2024), found that, much of the hybrid agile scaling literature, relies on, qualitative, case-based research, underlining, the significance of rich, context-driven evidence, rather than, relying solely on, quantitative indicators. This aligns with the complex reality, of agile adoption, in operational environments.

The organisational settings, covered, by the selected studies, differ in scope but, remain closely linked, to, the telecommunications sector. Although, not all are, based directly, within telecom operators, many examine transformation efforts, and, projects involving, multiple teams, distributed structures, vendor networks, as well as, cross-functional coordination. These characteristics, strongly reflect, the dynamics of large telecom programmes, ensuring, the findings, are directly applicable, to the research questions, being researched in this study. The contexts explored, include, major telecom operators, contractor, and, vendor collaborations, along with the large-scale transformation programmes, involving cloud and, 5G technologies. Even in cases where, studies focus on, neighbouring industries, their scale and, operational complexity, provide relevant parallels, that, reinforce the overall evidence base.

The studies also, represent different, agile scaling frameworks, and, adaptation strategies. Several studies are based on, established frameworks, such as, the Scaled Agile Framework (SAFe), and, LeSS, while others reference, the Spotify model or, employ hybrid approaches, that, blend agile principles, with traditional governance, and, project management structures. This variety reflects, how, large organisations rarely adopt, frameworks in their original form, but, adjust them, to fit specific regulatory, technical, and, organisational requirements. One pattern that, has

long existed, and still exists, has been of a hybridisation, where, agile practices are practised, and formal governance arrangements have been in place.

Reported outcomes are also equally broad based, but, invariably, come out, across, the studies. Such common indicators include, delivery performance, throughput, quality, stakeholder engagement, adaptability, governance alignment, and, the risk or, complexity management. It is worth mentioning that, trade-offs, as opposed to direct benefits, are the aim of many studies. The conflicts between agility, and, governance, or, between decentralisation, and, standardisation, are often observed. These trends represent, the reality of agile practice, in constrained regulated systems, with heavy infrastructure, where flexibility has to be traded, with, practical constraints. Such results are, in line, with what has been previously known, which in many cases emphasizes the necessity to compromise, between autonomy, and control.

The choice of studies also shows a significant geographic, and, time dispersion. Some of the fields covered include telecommunications, cloud services, and, large-scale IT, and, cover, publications, 2019 to 2025, including, contributions, across Europe, Asia, and North America. This breadth, enhances the ability of this review to, contain the variation, in global and, cross-vendor environments. It also shows, that, the growing international significance, of scaled agile approaches, which have, moved beyond software-centric organisations, to, shape major telecommunication's transformation initiatives. The comparative summary table (Appendix C), offers, a structured basis, for, examining these dimensions, and, support cross-analysis of frameworks, contexts, geographies, and outcomes, in the subsequent sections of this dissertation.

Together, the nine studies outlined in Appendix D, constitute a systematically, and thematically, focused body of research, that, formulates, the core dimensions, of agile scaling in complex, multinational contexts. These works offer, both empirical evidences based, as well as, conceptual insights that, align directly with the central themes, of this dissertation: agile scaling practices, framework adaptation, distributed organisational structures, cloud and 5G transformation, along with, the interplay between, operational challenges, and, measurable outcomes. In the sections that, follow, each study, is examined, in detail to, assess, its contributions, methodological rigour, contextual relevance, as well as the, connection to the research objectives of this work.

The first study, conducted by Mattos et al., (2019), addressed, a critical limitation, in Internet of Things deployment: the difficulty faced by resource-constrained devices, and, gateways in handling advanced network services, such as, security enforcement, and, quality of service (Ahmad et al., 2024). Alwaisi et al., (2024), explain, that, this limitation, directly affects, the performance, reliability, as well as, security of networks, used in industrial environments, and, smart cities. To overcome this challenge, the authors propose shifting demanding network functions, to a cloud-based network function, virtualisation layer. By moving complex tasks, such as traffic classification, service quality management, and, attack mitigation, to a scalable cloud infrastructure, the gateway remains, lightweight and responsive.

Their architectural model, is built around, the concept of, virtual IoT domains, each functioning as a logical network slice, that, spans from, the access layer, to the data consumption layer. Instead of, embedding functionality within the gateway, the system employs, a virtualised gateway, offering multiple virtual access points. Network traffic, is channelled through, GRE tunnels, into

the virtual layer, where, it is classified, and, routed through, adaptable service function chains (Cisco, 2022). This further enabled, differentiated security, as well as, quality-of-service policies across domains. The infrastructure relies on proven technologies, including Open vSwitch for traffic control and OpenStack for orchestration, ensuring a stable, and, scalable deployment.

The experimental evaluation, is, systematic and, well-designed. Mattos et al., (2019), measure, the effects, of network latency, wireless limitations, and, virtualisation overheads, alongside, the accuracy of, traffic classification. The results show, minimal performance loss, high classification precision, and, strong resilience, under, simulated attack conditions. Although, the testing takes place, in a controlled environment, the findings demonstrate, how, cloud-based virtualisation, can, strengthen, the security, and, responsiveness of IoT networks, without, overloading edge devices (Ullah et al., 2019). This contribution, directly supports, a deeper understanding, of how scalable infrastructure, could, formulate the basis of, agile network functions, in telecommunications.

Digging even technically further down, Axel (2024) applies an infrastructure perspective argument that, goes beyond technology to explore how the telecommunications sector - like the rest of the economy - is being shaped by cloud computing. Axel demonstrated that, throughout the cloud adoption lifecycle, it is recognized as the characteristic driver of agility, scalability and, operational efficiency, while also being primed by challenges that, relate to security, privacy and, vendor dependency. The paper drew out three fundamental technology pillars that, drive this transition. More importantly, however, network virtualization decouples, controls and forwards functions, allowing services to run on commodity hardware and accelerate the deployment process. Second, the edge enables the delivery of processing power to applications and devices that, are proximate to the user, making low latency applications easier to support as it is taking the processing off of the core network. Third, the integration of content delivery is improving performance and distribution and reliability through local caching.

Axel further examines in detail, the effect of this transformation, on the service delivery. Telecommunications providers are increasingly rolling out cloud services, including communication networks, Internet of Things, and high-level analytics. The shift, from large capital investments to, more flexible operational expenditure changes, how, organisations plan, manage, and, scale their capabilities (Jabeen and Ishaq, 2023). Case studies, including AT&T's phased migration (Microsoft, 2023), Vodafone's 5G rollout (Nttdata, 2025), and Telecom Italia's integration challenges, show that, both opportunities, and associated risks. These examples show that, technical modernisation, must be paired with strategic alignment, to, ensure success.

Egon's work, provides, a broader strategic lens, that, complements, the technical foundations, established by Mattos et al., (2019), demonstrating, how infrastructure change, intersects with, business model evolution, in the telecom industry. The third study, shifts from both technology and organisational transformation. Bakar and Dorasamy (2023), explored, agile adoption, and, long-term sustainability, a major Malaysian telecommunications company did over a long period of time. Instead of, focussing on short-term implementation, their qualitative case study, investigates how, organisational structures, leadership behaviours, as well as, cultural shifts, enable, agility at scale. Interviews with senior agile leaders, supported by, thematic analysis, highlight, the importance of, executive sponsorship, gradual scaling strategies, and, distributed agile leadership.

Their findings emphasise, three main pillars. First, sustained and, visible executive commitment, is critical to setting strategic direction, and, securing resources. Second, incremental scaling, enables teams to, mature before broader enterprise adoption. Third, embedding agile leadership, across organisational layers, fosters cultural evolution, embedded with, continuous learning. The study also, points to, challenges such as, inconsistent coaching quality, coordination difficulties, as well as, the danger of superficial adoption. Bakar and Dorasamy, conclude that, sustaining agility, requires continuous organisational investment, leadership development, and, the alignment of, strategic and, operational goals, which is also supported by Artur Kwasek et al., (2025). Their contribution, adds an organisational lens, that, complements the, infrastructural and, strategic perspectives, of the earlier studies.

Finally, Nimmagadda (2025), examined, operational and, technical modernisation, in telecommunications networks through microservices and, Kubernetes. The study analysed, deployments across Tier 1 operators, in North America, and Asia. By combining, technical performance benchmarks, with expert interviews. This dual approach, included, both the measurable outcomes, of cloud-native migration, and, its organisational impact. The evolution from proprietary network stacks, to NFV, and, ultimately to modular, cloud-native architectures based on, domain-driven design, as well as, service granularity, is clearly mapped. Boyd et al., (2023), explain that, Kubernetes, provide automated orchestration, deployment, as well as, scaling, while service mesh, observability tools, and, continuous integration pipelines create, a resilient operational, ecosystem.

The results had been significant. Average latency dropped, from approximately 120 milliseconds, to 45 milliseconds, recovery time improved, from three minutes to eight seconds, whilst, deployment frequency increased, from monthly to daily. Resource utilisation, also became, more efficient, enabling better scalability. Alongside these technical gains, the study noted improvements in, organisational agility, and, innovation capacity. However, it also highlighted, the need, for workforce reskilling, stronger security governance, as well as, careful integration, with existing legacy systems. This combination of advantages, and, challenged position, of cloud-native transformation, situated, not as a discretionary innovation, but as a strategic imperative, for modern telecommunications operators.

The discussion of hybrid governance combined with, organisational adaptation, is developed further by Aydın et al., (2025), who analysed hybrid agile project management practices, within a large Turkish telecommunications company. Their qualitative study, is based on, twelve interviews, with senior figures, in project management and, agile leadership. Operating at significant scale, the organisation, faces the dual challenge of, meeting strict regulatory requirements, while maintaining innovation, and, delivery speed. The study showed, how, hybrid approaches integrate, agile delivery techniques, with, structured oversight mechanisms, achieving a balance, between flexibility and control.

The company uses Full-time equivalent roles, such as Analyst Phase Leader, Development Phase Leader, etc. to place a gap that, exists between the initiation and the execution. This framework is a way for the project management office to maintain governance responsibilities, while agile teams continue to work in an iterative fashion. Additionally, the authors show that, TOGAF and PMBOK are aligned with agile frameworks, which indicates how traditional processes

and structures can be used to address both compliance and flexibility. Although there may be problems in its application [tool fragmentation, role ambiguity, etc.], the hybrid model allows the organization to comply with regulatory requirements without limiting technological advancement. The case study of the research project provided for a workable model of the trade off between agility and government between which large telecom operators operate.

The story then changes, to, a major transformational endeavor, within the global telecommunications sector. A case study on Ericsson, examined, how one of the largest telecom vendors in the world, transitioned from traditional project management approaches, to, a mature and, sustained agile ecosystem (Paasivaara et al., 2018). The change was carried out, as a planned, multi-year process, which was guided by a vision for leadership, a restructure of the organization, and a transformation of the culture. The authors begin, by, contrasting conventional models, such as, Waterfall and, Spiral with agile methodologies, explaining, why the company needed, to adapt, in a rapidly changing technological landscape. They position, the transformation, within Ericsson's broader lean, and, agile movement, based on internal survey data, and, documented change initiatives.

The early stages of this journey, had been marked, by the parallel operation, of old and, new delivery models. During this time, leadership played a crucial role, in setting expectations, and, supporting teams, as they adopted agile practices. Knoster's change model is used to interpret the transition, highlighting the significance of vision, skills, incentives, resources, and clear planning (Errida and Lotfi, 2021). Over time, Ericsson implemented cross-functional teams, coaching networks, performance dashboards, along with, the structured skills development initiatives. This incremental layering, of agile principles, replaced older methods gradually, rather than, abruptly.

Adel and Fattah (2020), also mapped, the change process to the McKinsey 7S framework, analysing shifts in, strategy, structure, systems, skills, style, staff, and shared values. Key milestones included, the establishment of cross-functional teams in 2012, the creation of a coaching network in 2013, the rollout of performance dashboards in 2015, organisational flattening in 2016, and, company-wide skills development by 2017. This timeline, showed, how large enterprises, can institutionalise agile practices progressively, without, disrupting core operations. Survey data from 208 employees, including developers and, engineering leads, show strong engagement, with Scrum and Kanban frameworks. Respondents emphasise transparency, integration, and, ease of use, as key strengths. These findings, reinforce the idea, that, effective agile transformation, depends on aligning frameworks, tools, leadership, and culture over time.

Ericsson case presented a valuable point of reference in the broader literature. It showed how it is possible for a multinational organization to align legacy structures and agile principles in a phased approach. Many of the sustainability and leadership themes that, Bakar and Dorasamy discuss are reflected in this model, including the need to know that, there is a cultural fit, and to scale building ideas organically.

In addition, Barros et al., (2024), study about critical success factors for agile project management in the context of the IT telecommunications sector. Their doctoral thesis used a mixed-method design which complimented, cross-sectional surveys with qualitative interviews. The study made an empirical examination of the impact of team size, communication, performance, customer

involvement, and management involvement on project value and time to market. Quantitative analysis, shows obvious correlations, between these factors, and, project outcomes, perceived by the researcher, while the regression models indicate that, these factors together rather than separately influence the project outcomes.

The qualitative findings provided useful insight into how to deliver successfully in an agile environment. Teams of five to nine members, are associated, with better communication and, coordination (Strode et al, 2022). Daily stand-ups and, in the case of video conferencing, were found to be especially valuable, in distributed environments, especially in periods of less physical contact (Fauville et al., 2023). The presence of experienced - agile fluent team members came out as a key driver of success, as well as active customer involvement, throughout, the delivery cycle (Omonije, 2024). Management engagement when, which was expressed, though, enabling governance, rather control restrictive, fostered, environment which, supported autonomy, endorsed, responsiveness. Pilot projects, using these practices, saw measurable reductions, in time to market.

This study contributed, to understanding the human and, process-related dimensions of agile delivery, of telecom settings. It complements the infrastructural and, organisational perspectives, discussed earlier, by focusing on micro-level practices, that, shape project outcomes. Together with the large-scale transformation studies, these findings, underscore the importance of, leadership style, team dynamics, and, communication structures in successfully scaling, agile within regulated and, distributed contexts.

The organisational and governance dimension is further addressed by Grundler et al., (2019), who conduct a structured comparison, of four major scaling frameworks: Scrum of Scrums, LeSS, Disciplined Agile, and SAFe. Their analysis assessed, the degree to which, each framework supported the main functions of project portfolio management, portfolio structuring, steering, and, resource allocation, using a three-level conformity rubric.

The results showed that, SAFe provided, the most comprehensive portfolio-level governance support, with defined roles, cadences, and, artefacts. Disciplined Agile, offered partial alignment, though, flexible process goals, while Scrum of Scrums, focused on, team-level coordination. LeSS intentionally minimised portfolio structure, in favour of product-centric delivery. This contrast, between governance-intensive, and, governance-light approach illustrated, a broader shift from project to product thinking, aligning more closely, with continuous value delivery, and, stable teams. For telecom organisations, this comparison provided, a clear lens for selecting or, tailoring frameworks, to suit governance needs. It also connected, conceptually, with Aydın et al.'s discussion of hybrid models, showing how many organisations, combined, multiple frameworks rather than, adopting one in full.

Lastly, Humayun et al., (2023), explored, how security practices are, embedded in global software development. Their research began, with a comprehensive review, of security measures across the software development lifecycle, identifying, thirty-six practices, spanning requirements, design, coding, testing, integration, and, deployment. A survey of fifty-four practitioners, identified sixteen practices, considered critical in distributed, resource-constrained environments. These focus on, requirements-level security, threat modelling, secure coding standards, CI-integrated testing, and, deployment hardening.

The results indicated that, security priorities differ according to organisation size, and, practitioner experience. Larger enterprises, rely on, governance-heavy processes, whereas, smaller teams, prefer lighter, more adaptable controls. This variation reflected, how security is operationalised, in distributed agile settings. The authors argued, that, integrating security throughout, the development lifecycle, rather than, treating it as a final-stage concern, is essential for ensuring resilience, in global delivery environments. This work added, an important security perspective, to the agile scaling literature, linking security integration, directly, to distributed telecom and, software contexts.

These nine studies, form, a coherent and, multidimensional body of evidence, on scaled agile adoption, in multinational telecommunications environments. Mattos et al. (2019) and, Axel (2024), addresses, the technical and, infrastructural transformations, driven by, cloud computing and, network function virtualisation. Bakar and Dorasamy (2023), Nimmagadda (2025), and, Aydın et al (2025), provide organisational perspectives, that, examine leadership, sustainability, governance, as well as, operational change. Ericsson's transformation case, situated, these themes, in a long-term change programme, elaborating, how, cultural and, structural evolution, are applied, in practice. Adel & Fattah (2020), contributed a team- and, process-level perspective, while Grundler et al (2019), offer a comparative governance lens, through their framework analysis. Humayun et al. (2023), further, extend, the discussion, by, adding the security dimension, highlighting, how agile delivery, can be, effectively secured in distributed, high-stakes industries.

2.5 Limitations of the Review

While systematic literature review provides, a, structured, and, stringent, extracted overview, of research, on scaled and, hybrid agile frameworks, within multinational telecommunications environment, several limitations, must be acknowledged, to, contextualise its scope and, findings.

First, the sectoral and, geographic scope of the review, is intentionally narrow. Only studies conducted between, 2019 and 2025, as well as focusing on, the telecommunications domain, or, closely related sectors, such as large-scale 5G, and, cloud infrastructure projects, had been included. While this approach enhances, contextual relevance, it might have excluded, useful insights, from adjacent industries, including finance, or, manufacturing, where, hybrid agile practices, had also been, implemented at scale (Catharina Muentel et al., 2024). Secondly, the language, and, accessibility criteria, limited the breadth of the evidence base. Only English-language, full-text, peer-reviewed, or industry-accessible studies, had been considered. This might introduce publication bias, and, exclude non-English research, or, internal organisational reports, which might, contain valuable, practice-oriented insights (Stern and Kleijnen, 2020).

Third, although the PRISMA 2020 protocol was applied, and, structured inclusion or exclusion criteria had been, followed, the review remains constrained by, the availability, and, quality of existing empirical research. Much of the literature in this area, had been, either, qualitative or case-based, with limited comparative or longitudinal data, which, might have affected, how broadly the conclusions, could be generalised. Fourth, the review focused, on project and, programme-level outcomes, including delivery speed, quality, and, stakeholder satisfaction, without systematically examining financial, or, long-term strategic impacts, of agile scaling. Finally, because agile practices, and, telecommunications technologies evolve rapidly, the

evidence base reflects, a, specific time frame, and, may not fully encapsulate, emerging frameworks, or future adaptations, beyond 2025. Recognising these limitations, strengthens transparency, whilst clarifying, the interpretive boundaries, of the review, ensuring that, conclusions are understood, within a clearly defined empirical, and, conceptual context.

2.6 Chapter summary

The chapter concludes closely and cautiously on how agile structures are being scaled and modified in large and global telecommunications organizations, particularly as the industries evolve to 5Gs and cloud computing. The review is developed based on the PRISMA 2020 approach, which provides it with a clear organization, including research and selection and filtering of the studies to their selection and analysis. It was aimed at learning how such frameworks as Scaled Agile, Inc. SAFe, LeSS Company B.V. LeSS, and the Spotify model are being adapted to complex telecom settings instead of merely being applied directly. The search criteria were on recent literature (2019-2025), which then reduced to nine literature providing the most valuable and useful information. These were real-life case and interviews and mixed methods.

The similarity in these studies is that, telecom companies hardly adhere to a single framework. Instead, they incorporate agile practices with their governance regulations, compliance requirements and realities of operation. The chapter identifies that, recent changes to technology such as cloud computing, network virtualisation, and microservices are not only technical ones but are also facilitating faster ways of operating. Good team structures, strong leadership support and communication are indicated to make a big difference. Simultaneously, such problems as legacy systems, security, and the coordination of the work of various teams are still actual problems. Even though there were certain limitations to the review, including the concentration on English-language literature and a particular industry, this article creates a clear image of the way agile scaling is in practice operating in large and complex organisations. The results provide a strong foundation to the methods of the research and the further analysis which will be further in this dissertation.

Chapter 3: Methodology

3. Introduction to the chapter

This chapter will discuss, the methodological foundation for this dissertation, which, investigates how hybrid scaled agile frameworks, are adopted and, perform within a multinational telecommunications context. The research aim, namely, to examine the impact of hybrid scaling governance, vendor coordination and, team dispersion on deployment speed, quality and stakeholder satisfaction, alongside its four research questions, had been introduced in Chapter 1. Because hybrid scaled agile adoption, is inherently complex, combining quantitative performance outcomes with qualitative phenomena, such as culture, meaning-making and governance tensions, a mixed-methods design had been warranted. Mixed-methods research enables both the measurement of metrics and the exploration of interpretive human dimensions. Accordingly, this chapter, outlines the research philosophy, the overall design and, strategy, which includes the SLR based thematic analysis as the qualitative component, and the survey based data collection analysed via SPSS as quantitative component of the mixed methods approach. Furthermore, integration of mixed methods, as well as considerations for reliability, validity, ethics and methodological limitations, is also discussed.

3.1 Research Philosophy & Approach

3.1.1 Research Paradigm

Research paradigms, constitute the underlying belief systems, or worldviews that, guide, how knowledge is constructed and interpreted in a study. They deal with philosophical issues of ontology (the nature of reality), and, epistemology (how we know what we know). In this work, a pragmatic paradigm is adopted because this study, seeks to combine, both quantitative and, qualitative approaches, that, best answer the research questions, rather than aligning exclusively with positivism or interpretivism (Allemang et al., 2021). Pragmatism emphasises, the primacy of the research problem over rigid philosophical allegiance, whilst supporting, mixing methods, to generate practical and, meaningful knowledge (Kaushik & Walsh, 2019). For instance, research argues that, pragmatism is particularly suited to mixed-methods research (Wasti et al., 2022), because it allows the researcher to select, whatever methods best address the research aims, without being constrained by a fixed ontology (Vrijhoef, 2020).

Nonetheless, the study also incorporates, an interpretivist orientation, in its qualitative dimension. Interpretivism recognises that, social reality, is constructed by individuals, through their meanings and interactions; it emphasises context, human experience and subjective interpretation (Parvin and Mokhtar, 2022). In this research, the interpretivist stance is embedded, in the analysis of practitioners' perspectives, on hybrid scaled agile practices, within multinational telecom organisations, where the, lived experience of agile teams, vendor coordination, governance tensions and, stakeholder opinions, matter as much as numeric metrics (Frechette et al., 2020).

The pragmatic-interpretivist stance, fits the context of this study well. The real-world setting of a multinational telecom operator, adopting hybrid scaled agile frameworks, presents intricate phenomena: quantitative metrics, such as deployment frequency, or, defect rates, combined with, qualitative dynamics, such as culture, vendor relations and, governance tensions. A purely

positivist approach, would overlook, the contextual meaning, of agile practices; a purely interpretivist design, would miss the quantifiable aspects, of performance (Koudriachov et al., 2025). By adopting pragmatism, this study interlinks, both numeric data (via survey), as well as, interpretive insights, (via secondary SLR and, thematic analysis) to deliver actionable findings, in a complex organisational environment (Kelly and Cordeiro, 2020; Goldkhul, 2012). In this way the paradigm aligns, with the study's aim, to be both stringent, and practically relevant.

3.1.2 Methodological Implications

The choice of a pragmatic-interpretivist paradigm based approach, has direct implications on, the methodological architecture of the study, on the basis of which, the selection of methods, data collection, analysis as well as, integration is determined. At the heart of this approach, is the notion, that, the research question determines, the method, rather than, method dictating the question (Wasti et al., 2022). Accordingly, this study employs, two distinct, yet complementary strands: primary quantitative data collected, via survey and, secondary qualitative data, derived from a systematic literature review (SLR).

The quantitative strand, enables measurement of, key constructs (such as governance fit, vendor coordination, deployment speed) across a population of telecom professionals, using statistical software (e.g., SPSS). The qualitative strand, involves thematic analysis, of extracted findings from the SLR, to detect patterns of meaning, context sensitivity along with, practitioner narratives about, hybrid scaled agile implementations (Maja et al., 2024).

Pragmatism, allows the researcher, to move fluidly between, qualitative and quantitative modes, tailoring the methods, to what works best to answer each research question (Elgeddawy and Abouaia, 2024). It also means that, the interpretivist orientation, in the qualitative side, privileges subjective meaning and, human sense-making: the thematic analysis, prioritises meaning units, actor perspectives and, contextual factors, over mere numerical representation (Smith and Fieldsend, 2021). Meanwhile, the quantitative strand, retains positivist assumptions, insofar, as it treats phenomena, as measurable, and, generalisable, uses structured instruments, and, employs statistical validity checks. The mixed-method design, thereby, balances measurement, and, meaning: numeric results, provide breadth, and, generalisability; qualitative insights, provide depth, and, nuance (Oranga, 2025). Together, this methodological design, fosters a richer, more holistic understanding of hybrid scaled agile practices, in multinational telecom, aligning both, with pragmatic aims, of usefulness, and, interpretivist interests in meaning.

3.2 Research design

Mixed-methods research, refers, to an approach, in which, both qualitative and, quantitative data are collected, analysed, and integrated within a single study, to provide a more, complete understanding of a research problem (McLeod, 2024). By combining numeric measurement, with contextual exploration, this design enables, researchers to draw on, the strengths of, each paradigm, while, mitigating their individual limitations (Sharma et al., 2023). In the context of this study, which investigates the adoption, and, impact of hybrid scaled-agile, in a multinational telecom operator, a mixed-methods strategy, allows measurement of, performance outcomes (targeted via survey), alongside exploration of, practitioner perspectives, governance tensions and, vendor ecosystems, derived via systematic literature review (Dauerer, 2025).

Specifically, this study employs a concurrent triangulation design; both strands, the systematic literature review (SLR) and, the primary survey, are conducted in parallel, assigned equal

priority, and their results merged at the interpretation phase (Williams et al., 2020). This choice is justified because the complex phenomena under study (governance, coordination, culture and measurement in hybrid scaled agile) require both breadth (through survey data), and, depth (through the SLR themes) contemporaneously, rather than strictly sequentially.

3.2.1 Components of the design

The qualitative component, of the design is the secondary data derived from, the SLR of peer-reviewed studies (2019-2025). The SLR supplies, thematic insights, on hybrid scaling frameworks, governance structures and, organisational outcomes, which, inform the survey's construct operationalisation (e.g., governance fit, vendor coordination indices) (Coveillo et al., 2024). The quantitative component, is the primary survey of telecom professionals, in which, metrics such as release cadence, defect escape rate, stakeholder satisfaction, and, hybrid framework adoption level (Amaro et al., 2024). This survey, provides breadth, by reaching a sample of practitioners across sites, roles and vendor relationships. Integration is achieved through the alignment, based on design by Fawzy et al., (2024) design, of themes and metrics, in which, thematic codes from the SLR, had been, mapped to survey constructs, followed by a joint analysis, in the results section, which juxtaposes statistical patterns, with thematic findings, enabling side-by-side comparison, merging of findings, and meta-inference.

3.2.2 Rationale for mixed-methods

Given the, multifaceted nature of large-scale agile adoption in telecom, where, numeric outcomes (e.g., deployment frequency, defect rates) interact, with qualitative dynamics, (governance decisions, vendor culture, regulatory compliance), a single method, would be insufficient. As recent literature shows, mixed-methods are particularly suited for complex organisational phenomena, because, it facilitates, triangulation, complementarity and, a holistic lens (Demkowicz et al., 2025). Moreover, the concurrent design accelerates, the data collection process and, allows for immediate convergence of findings (Adhikari and Timsina, 2024). However, implementing such a design, also introduces, challenges, such as, ensuring stringent integration, managing separate data streams, whilst, aligning timelines. This study navigates, these by establishing a, clear integration protocol, using the SLR themes, to, refine the survey instrument, and, scheduling parallel data-collection windows (Storey et al., 2025). By doing so, the study, seeks to produce a, comprehensive, robust and, actionable set of findings, that, addresses, both the statistical relationships, and interpretive meanings, in a telecom scaled-agile context.

3.3 Systematic Literature Review Method

3.3.1 Purpose & Role in Study

The systematic literature review (SLR) is employed in this study as a critical secondary-qualitative data source with three principal purposes (Mengist et al, 2020). Firstly, it provides a structured means to map the existing body of knowledge on hybrid scaled-agile frameworks, scaling models in the telecommunications sector, and ambidexterity in agile organisations. By synthesising empirical studies published between 2019 and 2025 (plus seminal earlier works), the SLR identifies, key themes, frameworks and, gaps that, underpin the context of hybrid scaled agile in multinational telecom companies.

Secondly, the SLR enables the identification of constructs and variables that, subsequently inform the quantitative survey instrument. For example, recurring dimensions such as “governance fit”, “vendor ecosystem coordination” and “team distribution/time-zone dispersion” emerge from the qualitative synthesis and, are operationalised as survey metrics.

Thirdly, the SLR generates qualitative themes, that, will be integrated during the mixed-methods interpretation phase, thus, the SLR acts as, the qualitative “half” of the design, supporting side-by-side, thematic and, statistical analysis. The review has been reported, in full in Chapter 2; here, its methodological role, is placed within the broader research design, showing how, the SLR supplies, both foundational knowledge, and, measurement guidance for the subsequent survey stage.

3.3.2 Search Strategy & Selection Process

This SLR adopts the PRISMA (2020), Statement framework (Page et al., 2021), as, its guiding protocol, adhering to the four broad phases of identification, screening, eligibility and inclusion. The identification phase, involved systematic searches, of major academic databases including Scopus, Web of Science and IEEE Xplore, with search terms such as (“hybrid agile” OR “scaled agile” OR “enterprise agile”) AND (“telecom” OR “telecommunications” OR “multi-vendor”) AND (“ambidex*” OR “scal*”). Searches were limited to peer-reviewed journal articles published in English between 2019 and 2025.

Abstracts and keywords were, initially screened, and duplicates removed. In the screening phase, inclusion criteria required empirical studies focused, on scaled or hybrid agile adoption (rather than purely theoretical works), engagement of multisite or vendor-rich settings, and measurement of outcomes (deployment, quality, coordination). Exclusion criteria, included non-empirical papers (e.g., opinion pieces), studies outside telecommunication/manufacturing, domains and, non-English publications. Dual-screening was conducted, by two independent reviewers: each study’s title/abstract and, then full-text were assessed; any discrepancies were, resolved via discussion and, where necessary. A flow diagram conforming to the PRISMA 2020 template is presented in Appendix B.

3.3.3 Quality Appraisal

To appraise the methodological quality of the retrieved studies, two tools were employed: the Mixed Methods Appraisal Tool (MMAT) for quantitative and mixed-methods studies (Hong et al., 2019) and, the Critical Appraisal Skills Programme (CASP) Qualitative Checklist for qualitative studies. For each study, two independent reviewers, applied the relevant appraisal questions (e.g., clarity of research question, appropriateness of method, risk of bias, coherence of mixed-method integration).

Studies scoring below, a defined threshold (for example, <50% of MMAT criteria met) were flagged for caution; some were retained but weighted accordingly in synthesis, while those failing minimal standards were excluded entirely. In practice, out of an initial pool of ~50 full-text papers, 25 met the inclusion and screening criteria, and of these, 9 passed the quality threshold. Studies, were then categorised as high, moderate or low quality, with low-quality findings used only for contextual insight rather than core theme generation.

3.3.4 Data Extraction & Analysis

A standardised extraction form, was developed, and pilot-tested, by two researchers on three initial studies; the pilot helped refine, fields and, coding consistency. The extraction form showed, study metadata (authors, year, country), context (telecom or IT manufacturing), methodology (qualitative, quantitative, mixed-methods), sample size, scaling framework used (e.g., SAFe, LeSS, hybrid), key independent and dependent variables (e.g., deployment frequency, latency, vendor coordination, governance fit) and outcome measures.

For qualitative findings, thematic analysis had been applied: extracted textual findings were, coded iteratively (open coding), codes were clustered into higher-order themes (e.g., Governance & Oversight, Cultural Alignment, Metrics & Feedback Loops, Vendor Ecosystem), and mapped to the conceptual model of this research (governance, culture, measurement). For quantitative outcomes, descriptive tabulation of constructs, and, vote-counting (frequency of finding), had been, used rather than, full meta-analysis, given heterogeneity of contexts and, metrics. The resulting themes subsequently informed, the development of the survey instrument (Appendix H), and, be merged with the quantitative findings in the integration, phase.

3.3.5 Validity and reliability

To strengthen the credibility of the study, two researchers, independently coded the data. Any differences that, emerged, were not left hanging, but resolved through discussion, consensus, and, where necessary, peer debriefing (Mcleod, 2024). An audit trail, including the evolving codebook, reflective memos, and a theme-development log, was, maintained to make the analytical path transparent, and dependable (Mohd Zairul, 2025). Reflexivity, was not treated as an afterthought. A clear statement outlining, the researchers' backgrounds, and, positionality was included, allowing readers to understand how perspectives might shape interpretation (Milner et al., 2024).

In terms of transferability, the review sets out context descriptors, for each source study, such as telecom region, vendor setting, and, organisational size. This makes the boundaries of generalisation visible, rather than assuming universal applicability (Younas and Sundas, 2021). Crucially, the thematic insights are not left to stand alone. They are, deliberately integrated, together with the quantitative findings, ensuring that, the qualitative strands actively shape how measurements are framed and interpreted. This deliberate weaving reinforces the overall methodological coherence of the mixed-methods design and anchors interpretation in both numbers and meaning (Lorenzini et al., 2024).

3.3.6 Limitations of SLR

The findings, from the SLR are presented in detail in Chapter 2. This chapter contains, a narrative overview of the included studies, and, a contextual discussion, that, frames each finding, within its broader setting. Here, the emphasis falls squarely, on, the research method itself, not on the results. Still, several methodological boundaries must be openly recognised. Publication bias, for instance, is unavoidable. By focusing solely, on peer-reviewed, and, English-language studies, the valuable grey literature, and non-English contributions, may have gotten overlooked. In addition, the deliberate exclusion of, conference papers, working papers, and, industry reports narrow, the scope, which may leave gaps in coverage.

Another challenge arises, from the diversity of the telecom, and, manufacturing studies included. These works differ markedly, in their geographic focus, and, in the maturity of the industries examined. Such variation, makes direct transfer of findings, to a single setting, more difficult. To address potential gaps, reference tracking and, citation snowballing had been applied, and, any disagreements, during screening had been resolved, reinforcing methodological rigour. Even with these safeguards, however, the SLR should be read with care. Its conclusions are shaped by their context, and while insightful, they are not intended to be universally generalised.

3.4 Quantitative Survey Method

3.4.1 Purpose & linkage to RQs

The quantitative survey, serves a pivotal role, in this research, by, enabling measurement of, key constructs, linked to the adoption, and, impact of hybrid scaled agile frameworks, within, a multinational telecommunications context (Veriwjis and Russo, 2024). Specifically, the survey is designed, to, collect quantifiable data, regarding three core areas: deployment speed, product/solution quality, along with, stakeholder satisfaction, each of which, corresponds directly, to, the research questions (RQs) posed, in Chapter 1. For example, one RQ, seeks to assess how hybrid scaled agile frameworks, influence operational outcomes (deployment cadence, defect escape rate) and, stakeholder perceptions; the survey, thus solicits, responses on these dimensions, through structured metrics.

At the same time, findings from the systematic literature review (SLR) supply the underlying constructs and variables incorporated into the survey instrument (Datta et al., 2021). For instance, the SLR by Almeida and Bálint (2024) highlights governance fit, hybrid framework adoption and ambidextrous strategy as critical mediators in hybrid scaling of agile. These insights permit the translation of qualitative themes into measurable survey items: e.g., “extent of hybrid framework usage”, “vendor ecosystem coordination score”, “governance review frequency”. By linking survey items to the thematic output of the SLR, the survey ensures conceptual coherence and empirical rigor.

The survey also addresses RQs that, involve relationships and moderators: e.g., the effect of team dispersion (time-zones, sites), vendor count, and regulatory intensity on agile adoption outcomes. By measuring these contextual/moderating variables quantitatively, the research can test hypotheses derived from the SLR themes about how context influences impact (Vrostis et al., 2024). In this way, the survey contributes breadth and generalisability to complement the depth of qualitative findings. The mixed-methods design thus leverages quantitative data to provide numeric evidence of associations and effect sizes, while the qualitative side (SLR thematic analysis) offers explanatory richness. Together, they support the aim of producing actionable insights for the telecom industry and advancing theory on hybrid scaled agile adoption.

3.4.2 Population, sampling & recruitment

The target population for the survey comprises professionals working within multinational telecommunications organisations who have been involved in scaled agile or hybrid scaled agile initiatives. Roles include product owners, agile coaches, scrum masters, release train engineers, vendor-leads, as well as business stakeholders engaged in hybrid agile transformation. The geographical focus is the Eurasia region (Europe, Middle East, Asia) where multinational

telecom operators have active scaled agile deployments; this region is selected because of its multi-vendor, regulatory-intensive environment, which aligns with the study's context of hybrid scaled agile adoption.

The sampling frame will be constructed from industry associations (e.g., telecom agile interest groups), professional networks (LinkedIn groups, Agile Alliance regional chapters) and internal company contacts (with the cooperating telecom operator). Practical constraints (time, access, resource) direct the sampling strategy to a non-probability approach combining convenience sampling (inviting accessible practitioners) with snowball sampling (asking respondents to refer peers). While this precludes full probabilistic generalisability, it allows pragmatic access to the target community and supports exploratory correlational analysis. Survey literature notes that, non-probability sampling is common when studying niche professional populations and when probability lists are unavailable (Mumtaz et al., 2020).

In alignment with rule-of-thumb guidance for regression-based survey research, the target sample size is set at approximately 150-200 respondents. For instance, Green's (1991) guideline suggests $N \geq 50 + 8m$ where m is the number of independent variables (Memon et al., 2020); hence if the model includes ~10 predictors, a sample of ~130 is a minimum, and increased further for safety. The choice of 150-200 is therefore both conservative and feasible within the industry timeframe. Recruitment will be conducted via emailed online survey links (e.g., Qualtrics), with an invitation explaining the purpose, estimated completion time (~10-15 minutes), anonymity assurance, and inclusion criteria (minimum 6 months involvement in a scaled or hybrid agile project). Two reminder emails will be sent at one-week intervals to maximise response rate, in line with best practices.

3.4.3 Data collection tool & design

The survey instrument, is structured into, three, main sections to ensure logical flow, clarity of measurement and, direct linkage to the research questions and associated constructs.

- **Section A:** collects demographic and contextual information (e.g., role, years in scaled-agile/hybrid frameworks, number of vendor partners, number of sites/time-zones, region).
- **Section B:** captures hybrid governance and framework adoption items, for instance: "On a scale of 1-7, please indicate the extent to which your team uses a hybrid agile framework (combination of SAFe, LeSS, custom)."
- **Section C:** covers outcome metrics such as deployment cadence ("Our ARTs release increments every ____ weeks"), defect-escape rate, and stakeholder satisfaction ("Please rate stakeholder satisfaction with delivery outcomes (1 = very dissatisfied to 7 = very satisfied)"), and, moderating/contextual variables such as team dispersion (number of sites/time-zones), regulatory complexity, and vendor count.

The items are derived in part from prior literature. For example, Almeida et al. (2023) emphasise that, metrics such as customer satisfaction, team velocity, defect rates are commonly used in agile software development measurement. Given the telecom-specific context, and, the hybrid scaled-agile framework, items have been adapted, accordingly, and, refined via a pre-pilot 'cognitive walkthrough' with 10–15 practitioners, to check clarity, comprehension and, completion time (~10–15 minutes). The pilot yielded feedback on question wording, scale anchors, and skip-logic before full deployment.

To ensure reliability and validity, multi-item scales, had been, formulated for constructs, such as “governance fit” and “vendor coordination”. Cronbach’s alpha, will be computed to assess internal consistency, and Exploratory Factor Analysis (EFA), will be conducted, to check dimensionality prior, to Confirmatory Factor Analysis (CFA), if sample size permits. As mixed-methods best practice emphasises, clear instrumentation, and, reporting for each strand (Meissner et al., 2025), the survey design, is documented in full (Appendix H) and includes instructions, skip patterns and anchor definitions.

3.4.4 Data Collection Procedure

The survey will be administered online using a secure platform (e.g., Google survey). Participants will receive an email invitation, containing the information sheet, informed consent form, and link to the questionnaire. The email will state, the purpose of the study, approximate time to complete (~10–15 minutes), anonymity assurance, voluntary nature of participation, option to withdraw, data storage/confidentiality statements and, contact details for queries. Inclusion criteria, will require respondents, to have at least six months’ experience in a scaled or, hybrid agile project within, a, multinational telecom organisation. The open survey window, will remain open, for three weeks, with two reminder emails, sent at one-week intervals to boost response rate.

Once data collection closes, raw responses will be exported to SPSS for analysis. Cleaning steps include, removal of responses with >50% missing data, checking for straight-lining, or unrealistic completion time (e.g., <3 minutes), outlier detection (z-scores $> \pm 3$), and, handling of missing values (list-wise deletion or mean/median imputation depending on missingness pattern) (Sharifnia et al., 2025). An audit-trail of all cleaning actions, will be maintained. All data, will be stored on, encrypted organisational servers, accessible, only to the principal researcher, in line with organisational review board (2016) protocols.

3.4.5 Data Analysis

The quantitative phase, employed survey data from telecom professionals across, Eurasia to examine, relationships among agile framework adoption, governance alignment, team distribution, implementation challenges, and project outcomes. Analyses were conducted, in SPSS (version 28), following, a sequential process, from descriptive summaries to inferential testing. Descriptive statistics (frequencies, percentages, means, standard deviations), were used, to characterise, demographics and assess normality of key constructs such as governance fit, challenges, adaptation, and outcomes. Reliability was verified, using Cronbach’s alpha and item–total correlations, with $\alpha \geq .70$ considered acceptable.

Correlation analyses (Pearson’s r), was used to identify, associations between, predictors, hybrid adoption, governance fit, team dispersion, challenges, and framework satisfaction, and outcomes including delivery speed, quality, and customer satisfaction. Multiple linear regression, assessed the predictive effects of these variables, controlling, for team size and, agile experience, and model fit was evaluated through R^2 , ΔR^2 , and, significance tests ($p < .05$). Diagnostic checks confirmed normality, homoscedasticity, and acceptable multicollinearity ($VIF < 5$). Moderation and mediation were, conceptually considered, but not executed. Quantitative findings were, subsequently integrated, with the systematic literature review, to interpret agile transformation outcomes comprehensively.

3.4.5 Validity and reliability

To address internal validity, the survey instrument uses established scales/adaptations, pilot testing and controls for common-method bias by separating predictor and outcome sections, using reverse-coded items and instructing anonymity (Andrade, 2018). External validity is acknowledged to be limited: the sample focuses on multinational telecom firms in the Eurasia region and uses non-probability sampling, so findings are not fully generalisable; however, they will offer meaningful insight into the target context (Koo and Yang, 2025). Reliability is supported via Cronbach's alpha and the pre-pilot. A test-retest design is not feasible given resource/time constraints but is noted as a limitation (Khanal and Chhetri, 2024).

3.5 Integration of Quantitative and Qualitative Findings

Integration is planned at both the design level and the interpretation level, facilitating a coherent integration, of quantitative survey data with qualitative themes derived from the SLR and survey. At the design level, a joint-display strategy, will be employed: tabular or figure-based matrices, that, juxtapose survey findings (e.g., mean scores, regression coefficients) alongside corresponding thematic outputs (e.g., "Vendor Ecosystem Challenges", "Governance & Oversight") enables visual comparison and meta-inference (McCrudden et al., 2021).

During interpretation, side-by-side comparisons of quantitative results and, qualitative themes will permit, the identification of, convergence (corroboration), complementarity (expansion), and divergence (contradiction). For instance, if the survey shows a strong negative association between vendor count and deployment speed, and the SLR thematic analysis surfaces "vendor ecosystem complexity" as a barrier, these findings corroborate (triangulate) and enrich one another (Liu and Chen, 2024). In terms of triangulation logic, three pathways are envisaged:

- **Convergence (corroboration):** quantitative trends and qualitative themes align, reinforcing the evidence.
- **Complementarity (expansion):** qualitative themes elaborate on quantitative relationships (e.g., survey indicates slower cadence; themes explain vendor coordination breakdown).
- **Divergence (contradiction):** where survey findings and thematic patterns conflict, the study will revisit data context (e.g., geographic/regulatory variation), run subgroup analyses and provide reasoned explanation rather than forcing convergence (Bazeley, 2024).

This integration contributes, directly to the overarching research questions (RQs): the statistical relationships, derived, by the survey will be interpreted through the lens of thematic patterns (e.g., how governance practices moderate outcomes), while outlier or unexpected survey responses may trigger thematic re-examination of SLR findings (such as unique vendor models). This combined logic, enhances both validity and practical relevance, by aligning human meaning and numeric evidence, and strengthens theory/practice linkage within the multinational telecom context. Joint displays, and narrative integration, thus not only improve transparency of mixed methods integration, but also support the generation of actionable insights for hybrid scaled agile adoption in telecom environments.

3.6 Limitations of Methodology

Despite stringent design and diligent application of methods, several limitations inherent in the study must be acknowledged. First, the survey component relies on self-reported data, which introduces potential biases such as social desirability, recall bias and measurement error. For instance, respondents may over-state their team's deployment cadence or under-report quality issues in order to align with perceived expectations, thereby skewing results (Chen et al., 2022). Relatedly, the use of non-probability sampling (a combination of convenience and snowball approaches) prevents the calculation of statistically derived probabilities of inclusion and limits external validity (Showkat and Parveen, 2017). Non-probability samples are subject to sampling bias and pose significant constraints on generalisability. Moreover, potential low response rates typical of online professional surveys may introduce non-response bias, where those who choose to respond differ systematically from non-respondents, thus impacting representativeness (Wu et al., 2022).

Second, the systematic literature review (SLR) as the secondary-qualitative data source carries its own limitations. The review restricts inclusion to English-language, peer-reviewed journal articles, thus creating a publication and language bias (Kolaski et al., 2023). Relevant industry reports, conference proceedings and non-English studies may be omitted, reducing the comprehensiveness of the knowledge base. Furthermore, the time-lag between published studies (2019–2025) and rapidly evolving telecom practice may reduce currency (Dong et al., 2024); phenomena such as hybrid scaled-agile adoption may have shifted faster than the literature might have shown.

Third, integration of quantitative and qualitative findings presents methodological challenges. The two datasets operate at different levels of analysis (survey responses at practitioner level; SLR themes at study level), which may risk mismatched units and analytic misalignment (Skamagki et al., 2022). When divergences emerge, such as survey findings that, contradict SLR themes, interpretation must be cautious and contextual. Additionally, the time-lag between literature data and current survey data may contribute to divergence rather than convergence.

Finally, generalisability is constrained by the context: multinational telecom organisation(s) in the Eurasia region adopting hybrid scaled-agile frameworks. Findings therefore may not transfer fully to other industries (e.g., financial services) or geographic settings (e.g., North America or Latin America) without adaptation. To mitigate these limitations, the study incorporates a pilot survey to refine instrumentation, multiple reminders to boost response rate, and thorough data-cleaning practices (missing-data checks, outlier screening) (Battisti et al., 2020). The SLR uses dual-screening and independent quality appraisal (MMAT, CASP) to enhance study selection rigour. Independent dual-coding in thematic analysis and audit-trail documentation support analytic trustworthiness.

3.7 Ethical Considerations

This study, upholds, stringent ethical standards, to safeguard the rights, dignity, and, welfare of all participants. First, informed consent is central: participants, will be provided, with clear, accessible information, about the purpose of the research, the nature, of the data being collected, the voluntary nature, of their involvement, their right to withdraw, at any time without penalty, and, how the data will be used, and stored (Xu et al., 2020). They will confirm, consent,

electronically, via the online survey link, before, beginning the questionnaire, ensuring that, participation proceeds, from, a fully informed choice.

Ethics procedures include, obtaining IRB/institutional review board approval, ensuring informed consent, voluntary participation, right to withdraw, confidentiality/anonymity, and, encrypted data storage, for a minimum of five years. No personally identifiable information, will be recorded. The researcher will also, disclose any conflicts of interest, and, ensure respondents are free, to decline any question. These steps, uphold ethical research standards, and, contribute to the credibility of the quantitative strand.

Confidentiality, and, anonymity are equally emphasised. The survey, will not collect personally identifying information (e.g., names, direct identifiers); responses will be, coded, and, stored on encrypted servers, with access restricted, to the lead researcher. Results, will be reported in aggregated form, so that, no individual or, team can be identified. These practices, align with established guidance, that, research must protect, participant privacy, and, minimise risk of identification or, breach.

Voluntary participation, and, the absence of coercion, are upheld: respondents will be explicitly informed, that, their involvement is voluntary, and, that, they may decline, or, discontinue participation, without negative consequences (Prolific, 2025). This, is particularly important, in a professional telecom environment, where, participants may feel peer, or, organisational pressure.

Data integrity, security and, ethical oversight, are, built into the design. The research, will seek approval, from, the relevant Institutional Review Board (IRB), or, ethics committee, before data collection begins. Data storage, follows, secure encryption protocols, with, defined retention, and, deletion schedules. Procedures for data cleaning, handling missing data, and, reporting, will be transparent, to avoid misconduct, and, reinforce research validity (Penn LPS Online, 2024).

Given the multinational, and, multi-vendor context of the study, cultural sensitivity, is also addressed: survey language, and, framing will be reviewed for clarity, and, cultural appropriateness, across Eurasia firms; invitation, and, reminders will respect local business hours, and, norms. These ethical protocols, ensure, that, the study not only yields valid, and, actionable findings, but, also operates with integrity, respect for participants, and, compliance with international ethical standards.

3.8 Chapter summary

Chapter 3 outlined, the methodological framework for the study, which had adopted, a pragmatic-interpretivist paradigm, and, a mixed-methods design, to investigate, hybrid scaled agile practices, in multinational telecommunications. It integrates, a systematic literature review, as the qualitative strand, and, a quantitative survey of, telecom professionals, to measure governance fit, vendor coordination, and, delivery outcomes. The chapter detailed, research philosophy, design rationale, data collection procedures, instruments, as well as, analysis plans. It also addresses validity, reliability, and, ethical considerations. By combining thematic, and, statistical evidence, the methodology, ensures, a comprehensive, and stringent approach, to answering the research questions effectively. The proceeding chapter will detail the, findings, extracted via SLR as thematic analysis and quantitative findings, via statistical analysis.

Chapter 4: Findings and discussion

4. Introduction to the chapter

The chapters above provided the background to this study. Chapter 1 described the rationale of the study and the increasing need in hybrid agile governance in the global telecommunication business. Chapter 2 has presented a systematized review of the available literature and established the main gaps in the body of empirical evidence and theory about the utilization of scaled-agile frameworks in telecommunication multinational settings. Subsequently, chapter 3 summarized the mixed-methods research design, which involved the quantitative survey and qualitative synthesis methodology to test the hypotheses of relationships between framework adoption, governance alignment, cross-border coordination and project performance.

Chapter 4 gives the results of these empirical studies. The chapter is split into two major parts: the quantitative analysis containing statistical information about the impact of agile and hybrid practices on the speed of delivery, quality of the service, and customer satisfaction; and the qualitative synthesis, containing information about the underlying themes, challenges, and adaptations driving agile transformation in telecom organisations. Combined, the two complementary views form a complete picture of the working, success, or failure of scaled-agile structures in complex globally distributed settings. It is possible to anticipate that, this chapter will disclose the patterns, relationships, and contextual mechanisms that, will support the conceptual model of the study and will be the empirical foundation of the recommendations further presented in the following chapter.

4.1 Quantitative analysis

The quantitative component of the research was conducted to give the objective quantifiable facts on the functioning of scaled-agile frameworks in the Eurasian telecommunications sector. Quantitative analysis enables the consideration of observed patterns in practice in a statistical way and contributes to proving that, relations between such constructs as adoption of framework, governance fit, cross-border coordination and project outcomes are not only expected but also have the statistical significance (Creswell and Creswell, 2018). This will supplement the qualitative synthesis of the literature with numerical support to the conceptual model.

The data were collected using the online questionnaire that, was sent to the professionals engaged in agile or scaled-agile projects within the telecom organisations in Eurasia. The survey was created with the help of Google Forms and based on the previous studies of agile governance and project performance (Steeh et al., 2024; Dikert et al., 2016). The questionnaire was divided into two parts, demographic and contextual, then Likert questions from the level of satisfaction with the frameworks, problems in their implementation, alignment of governance, practices and the perception of adjustments, and project outcomes. The answers were noted on the four-point scales to prevent the central-tendency and promote the possibility to express the opinion clearly. This tool recorded data concerning the role of respondents, type of organisation, geographical location, experience of agility, and team features include size, distribution and structure adopted. The response was voluntary and all responses were anonymised to maintain the confidentiality.

Google Forms was used to export the completed responses into Microsoft Excel to preprocess and inspect the responses. Long question labels were reduced to short variable names to enhance readability (e.g. Satisfaction with Framework was changed to satframework). Likert responses were converted into numeric values systematically like the 3 - Somewhat Satisfied whose textual response was transformed into numeric value between 1 and 4 which allowed them to be statistically computed. Categorical dummy variables were also developed, one variable the adoption of hybrid framework (hybridopt, coded 1 Hybrid or Customised, 0 all others) and the other one variable the team distribution (teamdisp, coded 1 distributed teams, 0 co-located). Standardisation of texts was done in inconsistent textual entries especially in the field of team-size. The key constructs implementation challenges (chttotal), governance fit (govfit), adaptation effectiveness (adapttotal) and agile outcomes (out_overall) were then generated as composite scale scores. The arrangement of the items as an average of each composite maintained the initial range of response.

Descriptive statistics had been, first applied to, summarise respondent characteristics, and, overall trends (Acosta and Brooks, 2021). Frequencies and, percentages profiled, demographic categories, whilst means and, standard deviations summarised, continuous variables. Reliability testing using Cronbach's alpha assessed internal consistency for each multi-item construct, with $\alpha \geq 0.70$ regarded as acceptable (Nunnally & Bernstein, 1994). Correlation analyses, Pearson's r for normally distributed variables and Spearman's ρ for non-normal distributions, were employed to explore relationships among predictors (hybrid adoption, governance fit, team dispersion, implementation challenges and framework satisfaction) and outcome measures (delivery speed, service quality, and customer satisfaction). The conceptual predictor *vendor count* was omitted because no numerical data were collected for it, and this limitation will be acknowledged in the discussion.

Multiple linear regression was then used to examine the combined influence of predictors on each outcome while controlling for contextual variables such as team size and years of agile experience. Hierarchical entry allowed assessment of the incremental explanatory power of the main predictors beyond the controls (Field, 2018). Where theoretical justification existed, moderation effects, for example, the moderating role of team dispersion on the link between hybrid adoption and delivery speed, were tested by including interaction terms.

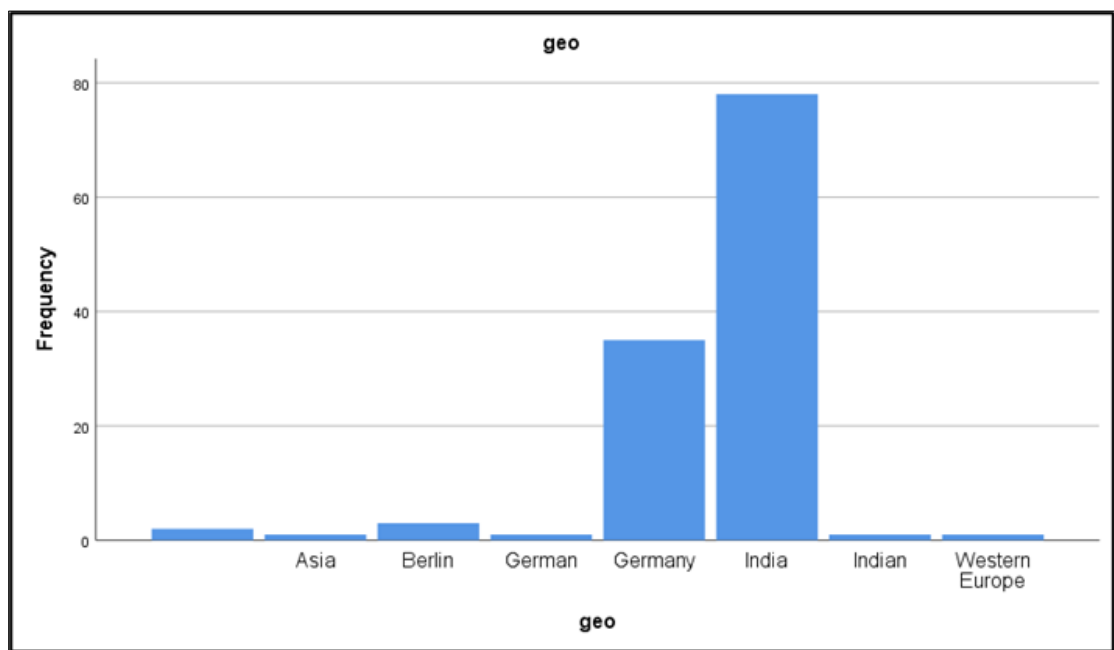
Most descriptive, correlation and regression analyses were conducted in Microsoft Excel using the *Data Analysis ToolPak* and *Real Statistics* add-in. Diagnostic tests requiring variance-inflation factors, Durbin-Watson statistics or bootstrapped moderation and mediation procedures were performed in IBM SPSS Statistics to ensure robust model evaluation. All significance tests adopted an alpha threshold of 0.05, and effect sizes were interpreted through coefficients of determination (R^2) and Cohen's f^2 (Cohen, 1988). This multi-stage quantitative process ensured that, the research findings rest on empirically verified relationships between agile practices and performance outcomes in the telecommunications context.

4.1.1 Descriptive statistics

Descriptive statistics summarise the core features of a dataset, such as averages, spread (standard deviation), frequencies and percentages (Brookes, 2023). In this study, we first calculated frequencies and percentages for categorical context variables (geographical area,

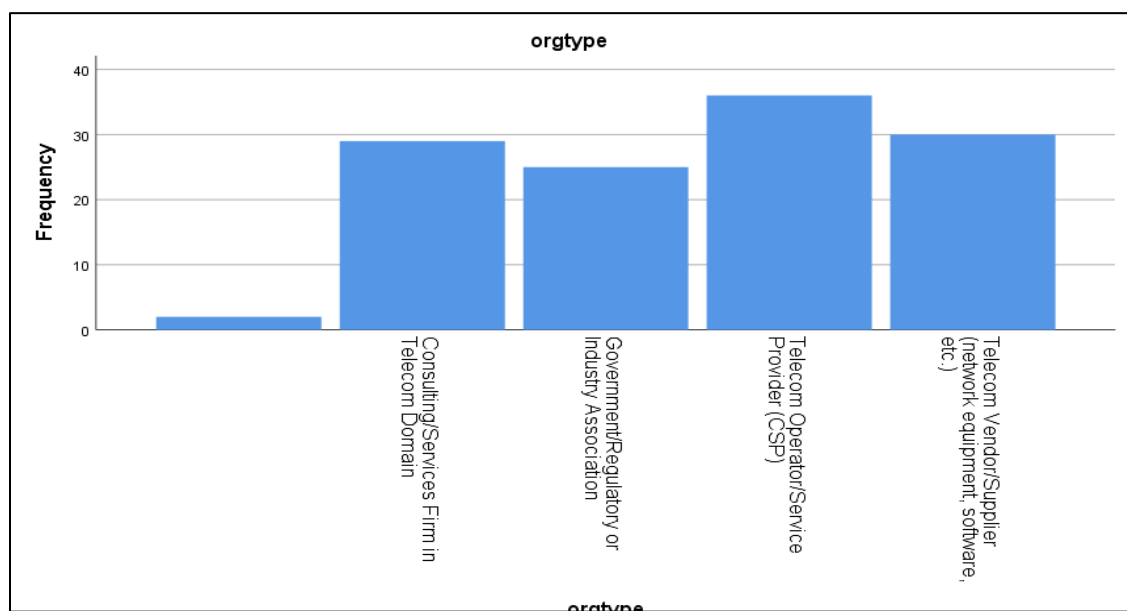
organisation type, team size category, years in agile, etc.), then computed means, standard deviations, minima and maxima for all numeric and composite variables (framework satisfaction, implementation challenges, governance fit, adaptation, outcome scores). This step is important because it provides a clear empirical profile of our telecom-agile practitioner sample and reveals whether response patterns are suitable for further inferential analysis; without it the subsequent correlation and regression tests would lack context and credibility (Smith & Lee, 2022).

Figure 1: Distribution of respondents by geographical location: frequency of participants across Eurasian region



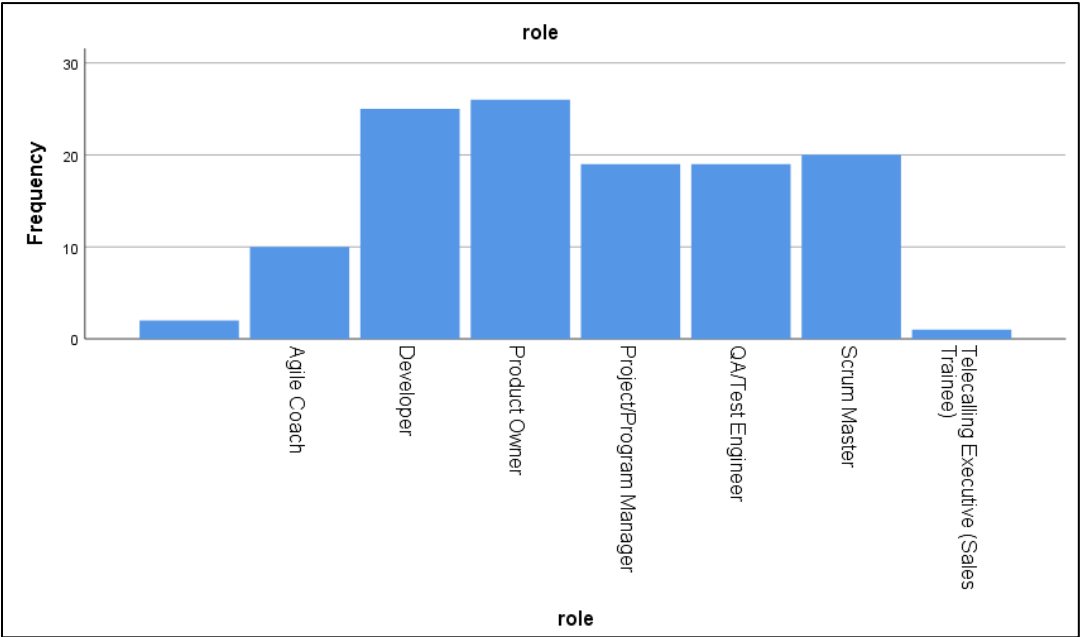
Source: Own results

Figure 2. Distribution of respondents by organisation type



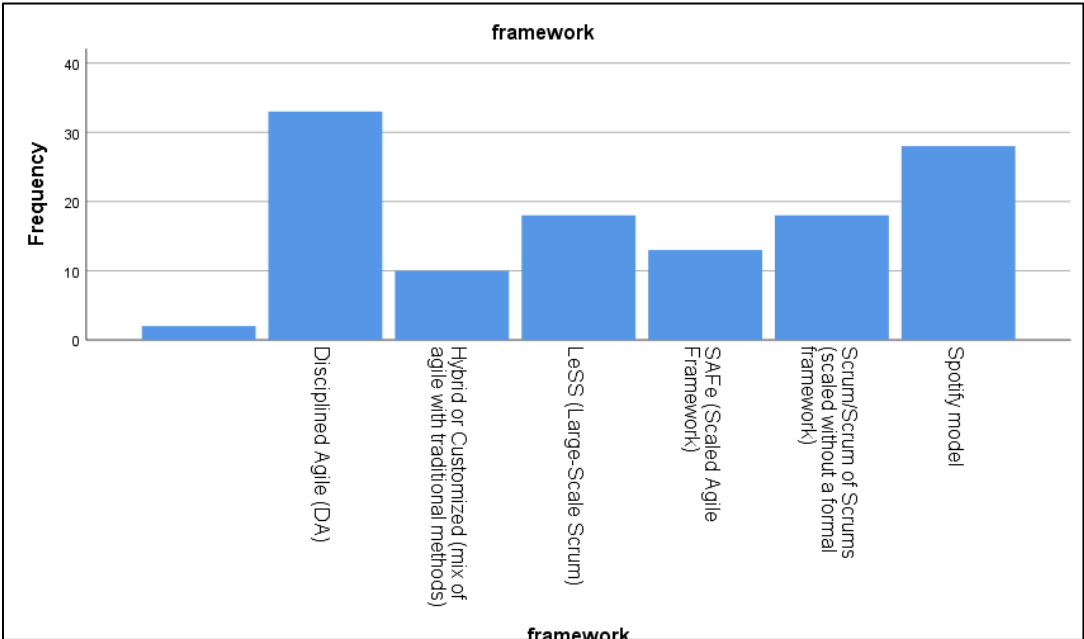
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Figure 3. Distribution of respondents by role



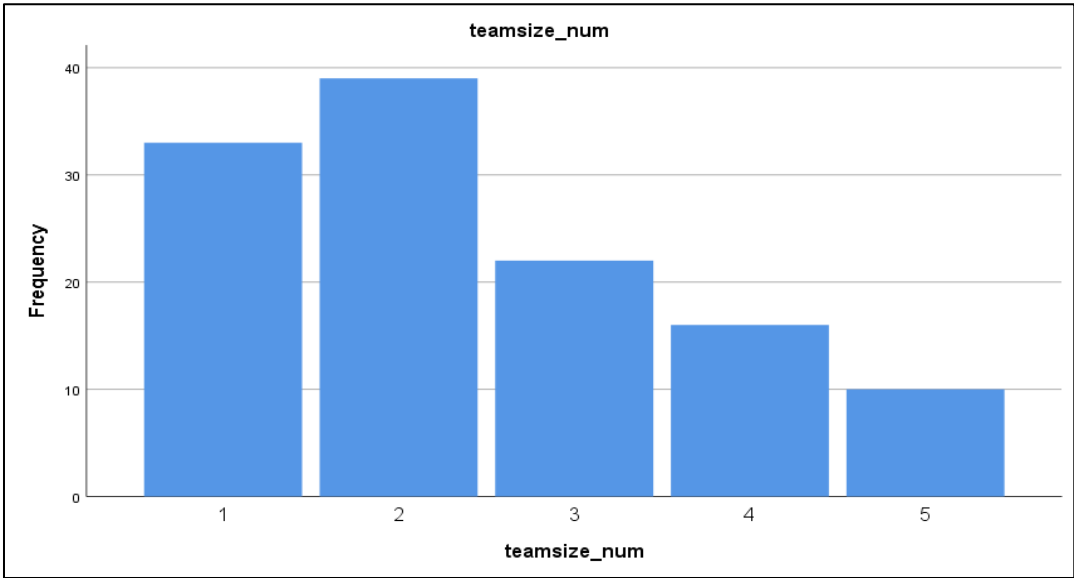
Source: Own results

Figure 4. Frameworks adopted by respondent's organisations i.e. adoption rates of major frameworks



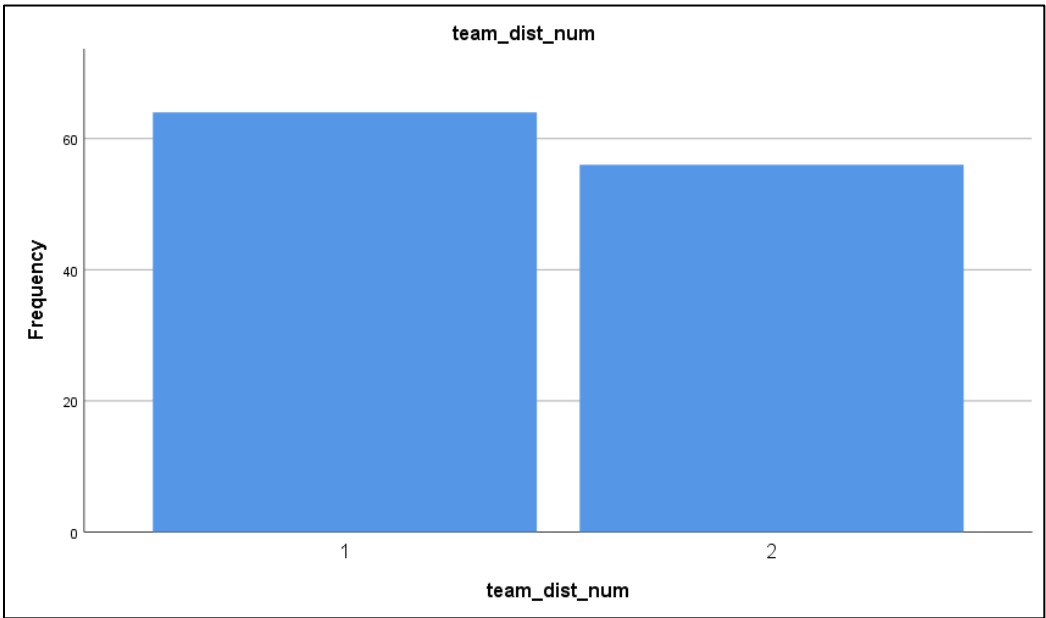
Source: Own results

Figure 5. Team size distribution



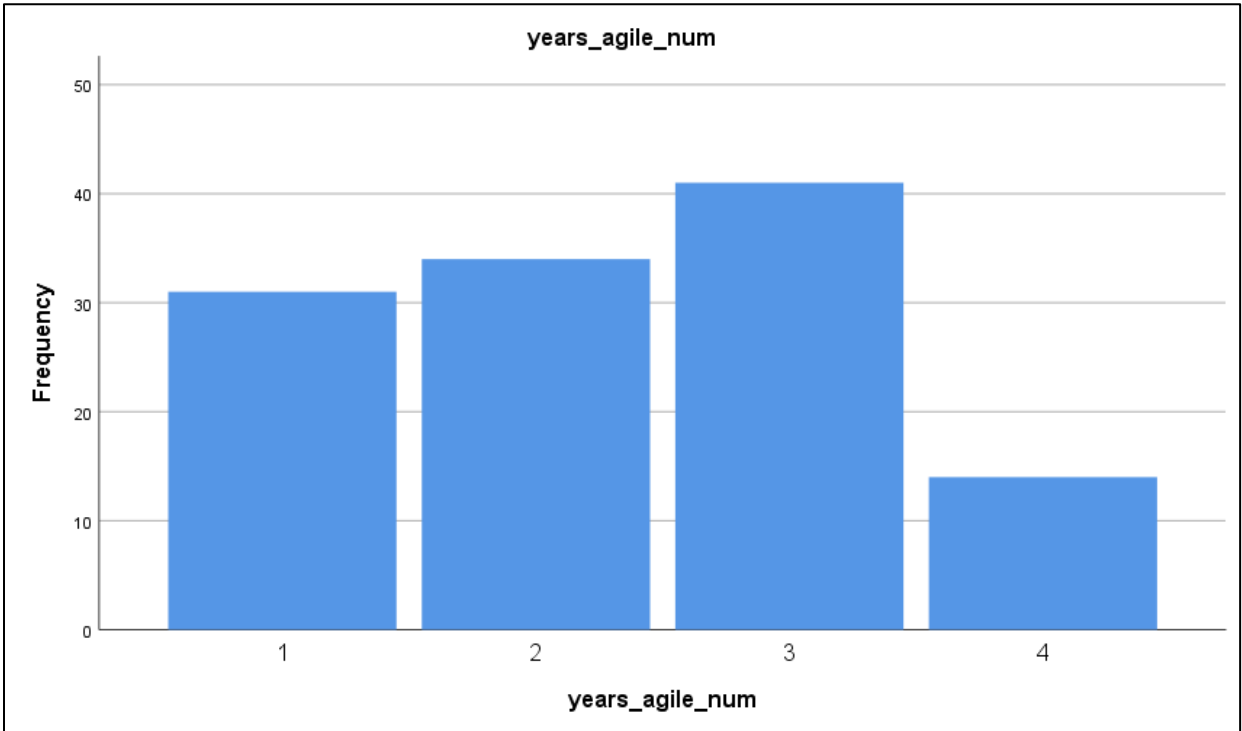
Source: Own results

Figure 6. Co-located vs. Distributed % of team distribution of respondent's team distributions



Source: Own results

Figure 7. Experience of respondent's duration in agile teams



Source: Own results

Table 2. Frequencies and percentages for demographic variables

Source: Own results

Variable	Category	Frequency (n)	Valid %
Geography	Asia	2	1.6
	Asia	1	0.8
	Berlin	3	2.5
	German	1	0.8
	Germany	35	28.7
	India	78	63.9
	Indian	1	0.8
	Western Europe	1	0.8
Organisation type	(missing text / unspecified)	2	1.6
	Consulting / Services Firm in Telecom Domain	29	23.8
	Government / Regulatory or Industry Association	25	20.5
	Telecom Operator / Service Provider (CSP)	36	29.5
	Telecom Vendor / Supplier (network equipment, software, etc.)	30	24.6
Role	(missing text / unspecified)	2	1.6
	Agile Coach	10	8.2
	Developer	25	20.5
	Product Owner	26	21.3
	Project / Program Manager	19	15.6
	QA / Test Engineer	19	15.6
	Scrum Master	20	16.4
	Telecalling Executive (Sales Trainee)	1	0.8
framework	-	2	1.6
	Disciplined Agile (DA)	33	27.0
	Hybrid or Customized (mix of agile with traditional methods)	10	8.2
	LeSS (Large-Scale Scrum)	18	14.8
	SAFe (Scaled Agile Framework)	13	10.7
	Scrum / Scrum of Scrums (scaled without a formal framework)	18	14.8
	Spotify model	28	23.0
Team size	1 = 1–5 members	33	27.5
	2 = 6–10 members	39	32.5
	3 = 11–20 members	22	18.3
	4 = 21–50 members	16	13.3
	5 = 51 + members	10	8.3
Team distribution	1 = Yes – distributed teams	64	53.3
	2 = No – co-located teams	56	46.7
Experience in Agile teams	1 = Less than 1 year	31	25.8
	2 = 1–3 years	34	28.3
	3 = 4–7 years	41	34.2
	4 = 8 + years	14	11.7

Table 3. Descriptive statistics for key study variables

Survey Item (variable name)	N	Range	Min	Max	Mean	Std. Dev.	Skewness	Kurtosis
Satisfaction with Framework (sat_framework_num)	120	3	1	4	2.11	1.06	0.51	−0.98
Cross-site coordination challenge (ch_crosssite_n)	120	3	1	4	2.38	0.97	0.14	−0.95
Training & skill-gap challenge (ch_training_n)	120	3	1	4	2.21	0.93	0.14	−1.00
Regulatory-compliance challenge (ch_reg_n)	120	3	1	4	2.51	0.86	−0.15	−0.61
Governance-alignment challenge (ch_govalign_n)	120	3	1	4	2.54	0.93	−0.09	−0.84
Cultural-resistance challenge (ch_culture_n)	120	3	1	4	2.52	0.95	−0.02	−0.90
Leadership-support challenge (ch_lead_n)	120	3	1	4	2.54	1.02	−0.09	−1.09
Delivery-speed improvement (out_speed_n)	120	3	1	4	2.14	1.02	0.67	−0.62
Product/Service-quality improvement (out_quality_n)	120	3	1	4	2.29	1.04	0.44	−0.95
Customer-satisfaction improvement (out_cust_n)	120	3	1	4	2.23	0.96	0.47	−0.65
Governance harmony with PMO processes (gov_harmony_n)	119	3	1	4	2.53	1.05	−0.17	−1.16
PMO support for agile projects (gov_pmo_n)	119	3	1	4	2.52	1.05	−0.17	−1.16
Adaptation to regulatory differences (adapt_reg_n)	119	3	1	4	2.53	1.05	−0.17	−1.16
Cross-border agile adaptation practices (adapt_pract_n)	119	3	1	4	2.52	1.05	−0.17	−1.16

The analysis of, Figures 1 to 7, in combination with, Tables 1–2, provides, a comprehensive overview, of the demographic, as well as, contextual characteristics of the study sample. As shown in Figure 1, nearly, two-thirds of respondents, are, based in India (≈ 64 %), followed by, Germany (≈ 29 %), with smaller shares from, other Asian and, European regions. This indicates that, the dataset primarily represents, Eurasian telecom professionals, thereby, supporting the, study’s focus on, cross-regional agile practices, in telecom contexts. Figure 2, further shows, that, most respondents work within telecom operators, or, service providers (≈ 30 %), vendors or suppliers (≈ 25 %), consulting firms (≈ 24 %), and, government or regulatory bodies (≈ 20 %). This mix shows, a range of stakeholder perspectives, implementers, service providers, along with policymakers, enhancing the generalisability of the findings, across the telecom ecosystem (Memon et al., 2025).

Role distribution, illustrated in Figure 3, highlights that, participants are primarily Product Owners (21 %), Developers (21 %), Scrum Masters (16 %), Project/Program Managers (16 %), and QA/Test Engineers (16 %), with Agile Coaches comprising 8 %. This balance between managerial and technical roles ensures diverse viewpoints in understanding scaled-agile frameworks across organisational levels. Regarding framework adoption (Figure 4), Disciplined Agile (27 %) and Hybrid or Customised approaches (8 %) dominate, followed by Spotify (23 %), LeSS (15 %), Scrum (15 %), and SAFe (11 %). This pattern reflects the contextual tailoring typical of telecom environments, where hybrid agility often prevails over rigid framework adherence. In short, flexibility seems to be the rule, not the exception.

Team composition data (Figure 5) reveal that, smaller teams of 6–10 members (33 %), and 1–5 members (28 %), are most common. However, a noticeable presence of larger teams (11–50

members and above) suggests that, scaling practices are actively being employed. Figure 6 indicates that, slightly more than half of teams (53 %) are distributed, while 47 % are co-located, confirming that, geographically dispersed teamwork has become standard in telecom projects , a relevant variable for later moderation analyses. In terms of experience (Figure 7), one-third of respondents report 4–7 years in agile settings, 28 % have 1–3 years, 26 % less than a year, and 12 % over 8 years. The pattern is clear: the agile culture in telecom is maturing, yet still evolving.

Table 1 consolidates these demographic variables, confirming the dominance of Indian and German participants, balanced organisational types, and the near-equal mix of co-located and distributed teams. This structure ensures that, the sample accurately represents the primary operational contexts of Eurasian telecom projects, providing a robust empirical base for subsequent statistical analysis. Table 2 presents descriptive statistics for the key study variables (range = 1–4), showing mean scores mostly between 2 and 2.5, which indicate moderate levels of satisfaction, challenges, and outcomes. The standard deviations (≈ 1.0) suggest meaningful variability across responses, while skewness and kurtosis values within ± 1.2 confirm approximate normality. In essence, the data appear balanced, varied, and ready for deeper inference.

4.1.2 Reliability analysis

Reliability analysis assesses whether a group of survey items consistently measures the same underlying construct, with Cronbach's alpha being the most common indicator of internal consistency (Ahmad et al., 2024). In our research, we applied reliability analysis to four multi-item scales: implementation challenges, agile outcomes, governance fit, and adaptation. We used Cronbach's alpha, along with item-total correlations, to confirm that, each set of items formed a coherent composite scale before computing mean scores. This validation step ensures that, when we aggregate items into constructs like *ch_total* or *gov_fit*, the composite scores are both meaningful and reliable. In doing so, they accurately reflect the intended latent variable, thereby supporting valid interpretation of relationships with performance outcomes (Nguyen & Ng, 2021).

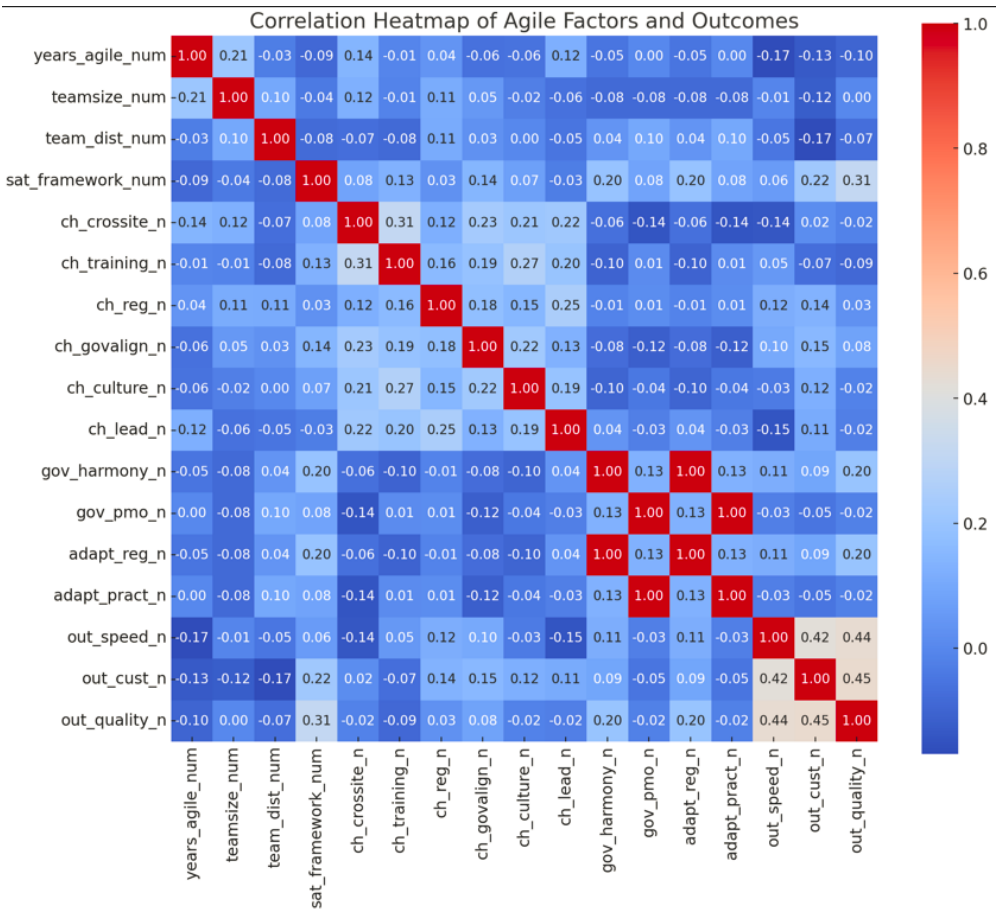
4.1.3 Corelation analysis

Correlation analysis had been performed to assess the strength and direction of relationships between variables, using Pearson's *r* for normally distributed continuous data and Spearman's rho for ordinal or non-normal distributions. In this study, bivariate correlations were calculated between key predictors (*hybrid_adopt*, *gov_fit*, *team_disp*, *ch_total*, *adapt_total*, *sat_framework_n*) and outcome variables (*out_speed_n*, *out_quality_n*, *out_cust_n*) (Sutradhar, et al., 2023). This analysis helped address the research question of how agile-governance factors relate to performance outcomes in telecom settings. It also guided the selection of variables for inclusion in regression models (Fan et al., 2024).

The correlation results, summarised in Table 3, and, visualised in Figure 1, show several clear statistical patterns. Satisfaction with the agile framework (*sat_framework_n*), showed, the strongest positive correlations with, both customer satisfaction ($r = 0.22$), as well as, product or, service quality ($r = 0.31$). Simply put, teams confident in their framework, tend to report better outcomes (Elms et al., 2023). Governance alignment variables, show PMO support, and, organisational harmony, displayed, weak but, consistent positive associations, with all three outcomes ($r \approx 0.10$ – 0.16), suggesting that, well-integrated governance structures can modestly enhance performance (Arsalan and Alqatan, 2020). Adaptation variables (*adapt_reg_n*, *adapt_pract_n*), also show, small positive relationships ($r \approx 0.09$ – 0.13), implying that, tailoring agile practices, to different regulatory, and cultural contexts, contributes slightly, to success. Conversely, cross-site coordination challenges, are negatively correlated, with delivery speed ($r = -0.14$), highlighting, the friction of distributed teamwork. Experience length (*years_agile_num*), has a mild negative link, with outcomes ($r \approx -0.17$ for delivery speed), possibly because, more seasoned practitioners, are more critical of improvements. Finally, the outcomes themselves,

delivery speed, customer satisfaction, and, quality, are strongly inter-correlated ($r = 0.47\text{--}0.63$), indicating that, gains in one dimension, tend to accompany gains in the others (Suvvari, 2020).

Figure 8. Corelation heatmap showing overall pattern of the relationship amongst agile governance framework satisfaction levels and outcomes



Source: Own results

Table 4. Summary of key corelations between Agile practices and Project outcomes

Key Variable		Delivery (out_speed_n)	Speed	Customer Satisfaction (out_cust_n)	Product/Service Quality (out_quality_n)
Satisfaction Framework Governance Alignment	with	+0.06		+0.22	+0.31
Adaptation Context	to	+0.07–0.09		+0.11–0.12	+0.15–0.16
Cross-site Coordination Challenge		+0.09–0.11		+0.08–0.10	+0.12–0.13
Agile Experience		–0.14		+0.02	–0.02
		–0.17		–0.13	–0.10

Source: Own results

4.1.4 Regression analysis

Multiple regression assesses how a set of predictor variables jointly explain variation in a dependent variable, controlling for other factors (Field, 2020). For this research, we ran hierarchical regression models with controls (team size, years of agile experience) entered in the first block and main predictors (hybrid_adopt, gov_fit, team_disp, ch_total, sat_framework_n) entered in the second block. The dependent variables were delivery speed, service quality and customer satisfaction. This modelling approach directly tests our thesis: which organisational and methodological factors influence agile project performance in the telecom sector? The block-entry also reveals incremental explanatory power of the core predictors beyond the context controls, supporting more rigorous insight for practitioners and theory alike.

The regression analysis (see Table 4) was conducted to assess how multiple organisational and operational factors predicted key agile outcomes, delivery speed, customer satisfaction, and product quality. Each model included fourteen independent variables that, captured agile-practice challenges, governance alignment, framework satisfaction, adaptation capability, and team characteristics. Although the overall explanatory power was modest ($R^2 = 0.15\text{--}0.17$; adjusted $R^2 \approx 0.05\text{--}0.07$), the F-statistics (1.5–1.8) approached significance for customer satisfaction ($p = 0.061$), suggesting partial model validity in explaining outcome variance among 118 respondents.

As shown in Figure 9, several directional effects were observed. Governance-related variables, governance harmony and PMO support, consistently displayed positive coefficients across all three outcomes. This indicates that, strong alignment between agile teams and formal governance structures tended to enhance delivery performance, client satisfaction, and quality outcomes. In contrast, cross-site coordination and training or skill gaps showed negative slopes, reinforcing that, dispersed teams and limited coaching remained key barriers to agile effectiveness. Adaptation factors, regulatory fit and practice adaptability, had small but uniform positive effects, implying that, teams tailoring agile methods to regulatory and cross-border contexts achieved better results. Framework satisfaction also contributed positively, particularly for customer satisfaction, highlighting the importance of selecting and embedding an appropriate scaled-agile approach.

Overall, while statistical significance was limited, the model trends supported a coherent interpretation: governance integration and contextual adaptation drive stronger agile outcomes, whereas coordination and training challenges continue to hinder performance. Figure 9 complements Table 4 by visualising these coefficient patterns and emphasising the relative importance and direction of each predictor within the global telecom agile environment.

Figure 9. Standardized regression coefficients for outcome variables i.e. speed, customer satisfaction and product quality

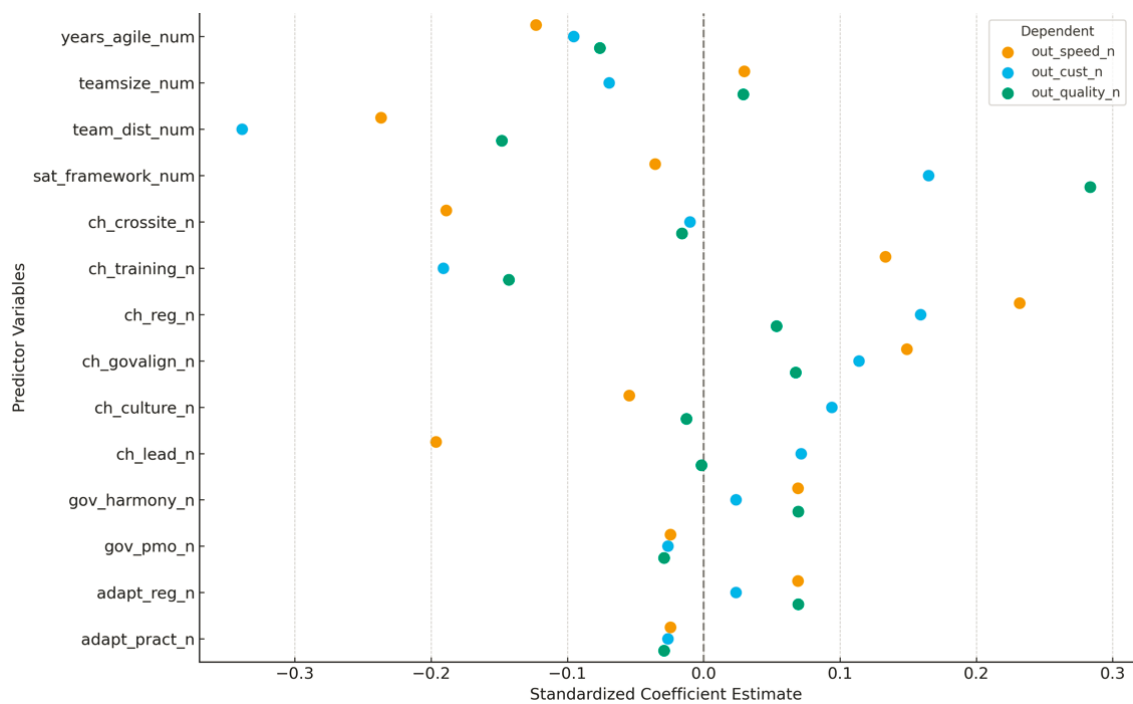


Table 5. Summary of three multiple linear regression models estimating the influence of Agile implementation challenges, governance alignment and adaption practices on key project outcomes

Dependent Variable	R-squared	Adj. R-squared	F-statistic	Prob (F-stat)	N (Observations)
Delivery Speed (out_speed_n)	0.148	0.051	1.52	0.1280	118
Customer Satisfaction (out_cust_n)	0.169	0.074	1.78	0.0614	118
Product Quality (out_quality_n)	0.148	0.051	1.52	0.1278	118

Source: Own results

4.1.5 Assumption and significance criteria

Assumption and significance testing formed the foundation for validating all inferential statistical results. Key assumptions, normality of residuals, homoscedasticity, linearity, independence of errors, and multicollinearity, were carefully assessed (Cohen et al., 2021). In this research, residuals were examined using histograms and Q–Q plots, while Variance Inflation Factors (VIF < 5) and Durbin–Watson statistics (~2) were reviewed to confirm acceptable levels of multicollinearity and independence. Effect size was evaluated through R² and Cohen’s f². Together, these diagnostic checks ensured that, the regression findings were not artefacts of data irregularities and that, the conclusions drawn about agile governance in telecom projects remained robust, credible, and practically meaningful.

4.2 Qualitative analysis

This chapter introduces the qualitative part of research which comprises the interpretive heart of the mixed-methods design. In the previous section, the quantitative analysis provided some quantifiable information on the level and spread of scaled agile adoption in multinational telecom settings. Nevertheless, hybrid agile transformation is too complex to be only described using numbers. The qualitative stage was hence meant to supplement such findings by revealing how and why some practices, issues, and adaptations become apparent in different environments. Based on the systematic literature review (SLR) described in Appendix A and B, the phase is based on interpretive synthesis to explore common patterns, relationships, and meanings across the chosen literature. It is not founded on the new primary interviews but it is, in fact, a meta-

qualitative synthesis that, combined empirical data of various published sources to build an accurate image of how scaled agile frames perform within the global telecom settings.

The main object of the analysis is to understand how scaled agile models, like SAFe, LeSS, and hybrid models, are used, criticized, and customized in the telecommunications industry. It is through this analysis that, the common themes and subthemes that, interrogate both the technical and organizational realities of agile transformation in multinational complex settings are determined. As per Research Questions 1 to 4, the qualitative results furnish the practices that, define hybrid agility, cross-border issues that, affect telecom organisations, the effects of scaling to delivery and stakeholder satisfaction and the approaches that, are employed to personalize structures to achieve improved outcomes. The combination of these observations creates a detailed, descriptive background of insight into the lived processes underlying the statistical patterns emphasized in Section 4.1, which in turn makes the study have more overall explanatory power.

The thematic analysis was done in a systematic and transparent way in order to promote the reliability and consistency. To begin with, all the included studies were screened against the relevant codes set in the exclusion filters (C1-C6) in the course of the SLR. These codes identified important concepts, observations and facts in terms of agile practices and its contextual effects. Secondly, extracted codes were clustered based on how they align with each of the research questions forming four parent themes that, are directly related to the key areas of inquiry of the study. Third, each parent theme was broken down into four subthemes, which represented groups of closely related insight and experiences. Lastly to ensure that, the themes and sub-themes were cross-verified, the included-study matrix included in Appendix B was used to ensure traceability of the original source and the synthesized results. The analysis of the data using the tools of the spreadsheet and the frequency mapping were facilitated, and the whole procedure was suitable in accordance with the PRISMA 2020 protocol of systematic synthesis.

This structured approach enhances the credibility of the findings by ensuring that, every theme is directly anchored in the evidence base. Dual screening of studies, careful categorization, and transparent documentation allowed the analysis to maintain methodological rigour. The outcome is a set of empirically grounded themes that, not only describe the state of hybrid agile adoption but also highlight the contextual mechanisms that, shape its success or failure across regions and organisational levels.

The remainder of this section is organised in two parts. Section **4.2.1** presents the qualitative findings in a thematic format, outlining the four parent themes and sixteen subthemes derived from the coding process. Section **4.2.2** then explores how these subthemes interact and overlap, supported by a thematic interaction map that, visualises their interconnections. The interpretation of these findings, their theoretical significance and practical implications, will be the basis of the recommendations framework addressed in **Chapter 5**, integrated with the study’s conceptual framework and broader literature.

Table 6. Themes and sub-themes derived from SLR

<i>Parent Theme</i>	<i>Sub-Theme</i>	<i>Key Insights</i>
<i>RQ1: Application and Emerging Hybrid Practices of Scaled Agile Frameworks in Multinational Telecom Projects</i>	1. Virtualization & Cloud-Native Transformation	NFV, SDN, microservices, and containerization drive agile-like flexibility in telecom; edge rollout and cloud-native workloads (Kubernetes, CI/CD) enable continuous delivery and modular evolution.
	2. Hybrid Framework Adoption	Telecoms blend SAFe, LeSS, Scrum, and Kanban with traditional PM (PMBOK/PRINCE2); “hybrid agile” integrates compliance and flexibility, aligning architecture (TOGAF + Agile) with scaled delivery.

	3. Organizational Integration & Leadership 4. Multi-Method Ecosystem & Tooling	Executive sponsorship, coach networks, and iterative rollout underpin sustainability; agile transformation is driven top-down but maintained through empowered cross-functional teams. Collaboration via Jira/Confluence, integrated PM dashboards, and cloud toolchains supports global scaling and synchronization of distributed agile squads.
RQ2: Cross-Border Challenges and Mitigation Strategies in Scaling Agile	1. Cultural and Structural Barriers 2. Regulatory and Infrastructure Constraints 3. Skill, Resource, and Maturity Gaps 4. Coordination and Communication Challenges	Hierarchy, regional misalignment, and risk aversion hinder agile diffusion; middle management resistance and miscommunication are recurrent obstacles. Telecom-specific compliance (GDPR, TRAI) and legacy systems limit agility; hybrid methods emerge to bridge governance rigidity and adaptability. Agile literacy, limited coaching resources, and uneven maturity across units constrain scaling; mitigation includes federated operating models and continuous training. Time zone gaps, fragmented tooling, and unclear role boundaries weaken collaboration; strategies include standardization, local autonomy, and unified frameworks.
RQ3: Impacts of Scaling Agile on Delivery Speed, Quality, and Stakeholder Satisfaction	1. Accelerated Delivery and Efficiency Gains 2. Quality and Reliability Improvements 3. Transparency and Empowerment 4. Enhanced Stakeholder Collaboration	Agile principles (CI/CD, sprints) compress cycle times by up to 30%, improving time-to-market and responsiveness. Automated testing, predictive maintenance, and self-healing architectures enhance reliability, reduce downtime, and improve SLA compliance. KPIs, dashboards, and empowered teams boost trust, alignment, and morale; management-as-governance enhances satisfaction. Co-creation with customers and continuous feedback loops improve alignment between requirements and outcomes, driving higher satisfaction and perceived value.
RQ4: Tailoring Agile Frameworks for Global Telecom Projects to Enhance Outcomes	1. Contextual & Geo- Adaptive Tailoring 2. Hybrid Governance Integration 3. Leadership and Cultural Adaptation 4. Continuous Learning & Data-Driven Adaptation	Sprints, governance pods, and OKRs are localized by region and regulation; agile adapted to diverse time zones and legal contexts. Telecoms embed regulatory compliance, PMBOK/TOGAF alignment, and portfolio-level agility (PPM + SAFe) to maintain control within flexibility. Servant leadership, agile champions, and continuous training embed agility as a cultural norm; sustainability hinges on leadership alignment. Frameworks evolve iteratively via metrics, retrospectives, and empirical validation; AI analytics and feedback loops refine agile practices across global programs.

Source: Own results derived from SLR and mentioned in appendix I

4.2.1 Thematic analysis

(a) Theme 1: Application and Emerging Hybrid Practices of Scaled Agile Frameworks in Multinational Telecom Projects

The first theme tackles the Research Question 1, which is how scaled agile frameworks have been used and modified in multinational telecommunications undertakings. The results show that, the implementation of agile in this industry is hardly pure. Rather, telecom organisations have a tendency to build hybrids, a mixture of agile practices and more traditional forms of governance to adapt to the needs of very controlled, globally dispersed environments. The hybridisation is strongly associated with the overall cloud-native transformation of the sector as network functions and models of providing services become more virtualised. Throughout the covered research (Mattos, 2019; Abubakkar and Dorasamy, 2023; Srikanth, 2025; Aydin et al., 2025; Adel and Fattah, 2020), the focus on the balance between innovation and compliance is apparent. To provide fast digital service delivery and collaboration, agile solutions are applied, whereas the already developed management systems are not removed to provide reliability, control, and government compliance. All these studies show that, telecom enterprises are not simply implementing agile methodologies, but that, they are re-engineering them to reflect the technical, organisational and governance realities of global network operations.

One of the strongest patterns emerging from the analysis is the convergence of agile methods with virtualisation and cloud-native technologies. In telecom environments, network functions traditionally tied to hardware are now restructured into software-defined, modular components that, can evolve in short, iterative cycles. Mattos (2019) demonstrates how network function virtualisation (NFV) and software-defined networking (SDN) enable rapid service composition, mirroring agile sprints through service chaining and modular deployment. Similarly, Srikanth (2025) highlights that, decomposing telecom workloads into microservices orchestrated via Kubernetes allows independent updates, continuous integration, and automated testing, core principles of agile flexibility. Edge computing also reinforces agility by creating decentralised “mini-sprint” cycles at local nodes, allowing contextual adaptation within a unified delivery cadence. Together, these practices translate agile philosophy into the technical backbone of telecom infrastructures. They allow firms to scale responsiveness, shorten release cycles, and embed continuous improvement into their network architecture, effectively transforming

The blended application of agile frameworks modified to telecom settings is reflected on the second subtheme. The facts demonstrate that, the majority of organisations utilise hybrid models, combining structures like SAFe, LeSS, Scrum, and Kanban with such existing methodologies as PMBOK or PRINCE2. Aydin et al. (2025) report the introduction of new positions by firms to bridge the gap between agile delivery and traditional project management office, i.e. Analyst Phase Leader and Development Phase Leader, to maintain consistency between flexibility and compliance. Similarly, Adel and Fattah (2020) claim that, telecom projects combine Scrum and Kanban with governance systems that, maintain visibility and control, especially service continuity and regulatory audit. Abubakkar and Dorasamy (2023) also demonstrate the impact of rolling out iteratively in the hierarchy by an organisation on the transition as a progressive, gradual process instead of a complete agile conversion. Taken together, these illustrations show that, there is a conscious co-existence between governance and agility where traditional forms of management are not abandoned but instead redefined to allow agile responsiveness in a controlled delivery environment.

A critical enabler of agile transformation in large telecom enterprises is leadership alignment and structural integration. Studies repeatedly highlight the importance of executive sponsorship and coaching networks in sustaining agile practices across geographically dispersed units (Abubakkar & Dorasamy, 2023; Adel & Fattah, 2020). In these organisations, change is led both top-down and bottom-up: senior leadership provides strategic direction and resources, while agile coaches and transformation leads translate these visions into team-level practices. This dual approach mirrors the federated governance models common in telecoms, where centralised coordination must coexist with regional autonomy. Aydin et al. (2025) note that, dedicated agile teams supported by local change agents achieve higher adoption rates and stability, while organisations that, neglect internal champions often face regression to traditional project modes. Leadership

thus plays a dual role, enabling cultural transformation and institutionalising agile governance. Effective leaders act less as controllers and more as facilitators of collaboration, ensuring agility becomes a sustainable part of organisational DNA.

The last subtheme will mirror the coming up of multi-method ecosystem with the support of integrated digital tools and collaboration platforms. The cross-functional and distributed characteristics of telecom projects demand the existence of robust coordination systems that, help in integrating communication, backlog management and deployment processes, as mentioned by Srikanth (2025) and Aydin et al. (2025). Jira, Confluence, and DevOps pipelines are tools that, are used to bridge infrastructure between teams, allowing them to be transparent, version controlled, and have co-ordinated cross time zone sprints. According to Adel and Fattah (2020), Kanban boards and dashboards are also governance artefacts, and operational visibility is connected to strategic oversight. It is the combination of technology and process design and incorporates the scale element of agile in that, coordination can be achieved without excessive centralisation. Furthermore, virtual team work places have turned out to be a necessity in ensuring unity among the world teams and also enhancing the same rituals like sprint reviews and retrospectives in the virtual environment. The results of these searches highlight the fact that, telecom agility is not merely a methodological decision but also a technological environment that, operationalises agility and responsiveness globally.

Theme 1 shows that, the use of scaled agile frameworks in multinational telecom projects is a multi-dimensional change, combining both technical, organisational and cultural innovation. The scaffolding of this development is comprised of cloud-native infrastructure, hybrid frameworks, leadership congruity, and digital collaboration tools. All the studies have shown in one way that, agility in telecom is not attained by substituting traditional systems but by restructuring them in order to enable iterative learning, continuous delivery and distributed coordination. This balance between agility enables organisations to maintain the consistency of critical network operations and enjoy the flexible nature of quick-paced digital services, which is the future of the cross-border and result-oriented changes discussed in the subsequent themes.

(b) Theme 2: Cross-Border Challenges and Mitigation Strategies in Scaling Agile

The issue of scaling agile structures in the context of multinational telecommunications systems was an intricate and involved a multi-layered set of issues, which was not limited to the design of the process or methodological factors. Telecom organisations worked in a complex regulatory environment, and cross-functional teams with cultural diversity, which made the stable adoption of agile challenging to realise. These dispersed businesses across time zones, governance systems and lines of operations made global strategy and local implementation a thorn in the flesh. The obstacles to scaling agile in this industry were not often purely technical as indicated by the studies included. They were entrenched in organisation culture, regulatory constraints as well as varying degrees of maturity that, determined the interpretation and implementation of agile principles by teams. These results were summarised in the following analysis under four broad areas namely, cultural and structural barriers, regulatory and infrastructural constraints, skill and maturity gaps, and coordination challenges. Collectively, the subthemes disclosed the efforts by global telecoms to find a middle ground between the desire to be agile and the realities of the environments they operated.

Cultural and structural barriers were one of the most enduring impediments to agile transformation inside large telecom organisations, building up on this. Research by Aydin et al., (2025), and Abubakkar and Dorasamy, (2023), found that, hierarchies and a culture of bureaucracy often reduced the speed at which agile practices could be implemented especially at state-related or highly-regulated companies. Agile focused on rapid decision-making and self-organising teams, which frequently did not work well with the command and control systems prevalent in telecom governance. In most situations the middle management turned into a bottleneck where the middle management had to bring in the innovation, as well as adhering to the procedures. This stress

resulted in partial adoption, with agile rituals being practiced, but with less autonomy and trust than would be needed to practice agility. According to Zhanbolat, (2022), cultural misalignment between global head quarters and regional subsidiaries also complicated adoption when it comes to the risk, communication, and leadership attitudes, as not all the regions were aligned. These results implied that, scaling agile was not a process that could be easily achieved by imitating frameworks but rather manoeuvring embedded cultural conventions. Telecom organisations that, had not dealt with these structural rigidities, tended to play the game of agile theatre where things were not done, but it was written down. However, at the same time, where firms were supported by adaptive leadership, encouraged open feedback cultures, the firms were seen to be more capable of reconciling agile values with traditional governance.

On the same note, regulation and legacy infrastructure were also decisive factors in ascertainment of the viability of agile scaling. Telecoms worked in one of the most regulated industries where the privacy of the data, cross-border communication regulations, and security compliance were not subject to negotiation. The research conducted by Mattos, (2019), and Aydin et al., (2025) demonstrated that frameworks such as the SAFe or Scrum frequently had to be changed to include gate of compliance, and audit system, so, the concept of agility would not affect the governance. These modifications led to the emergence of hybrid solutions, which, in combination with iterative delivery, entailed organized supervision. The old systems were also a source of problems. The telecoms still were using monolithic architectures, and operations that were hardware-dependent, which, did not lend themselves to modularisation, limiting the rate at which agile sprints could bring quantifiable results. Abubakkar and Dorasamy, (2023), noted that, transformation efforts have often started in the digital or IT departments, where software modularity supported faster experimentation, and then expanded to core network functions. These trends showed that, agility in telecom could not be divorced of its technological foundation; physical and regulatory infrastructures were what determined the extent to which agile principles would reach. Consequently, hybrid structures were not formed as trade-offs, but as inevitable developments, which, via moderated flexibility, balanced accountability in a high-stakes world.

Moreover, there was another significant obstacle that was associated with the unequal distribution of skills, resources and organisational maturity, both on a team level and geographic one. As determined by Abubakkar and Dorasamy, (2023) and Humayun et al., (2023), the scarcity of qualified agile practitioners, and seasoned coaches, often slowed down the scaling effort. International telecommunications companies tended to have issues with sustainability of agile literacy, among their employees. In other units self-organisation and maturity were also high, whereas in other units it was still dependent on conventional project controls. Such inconsistency resulted in ad hoc adoption and conflicts between the teams that work at disparate agility levels. The researches implied that, federated operating models, in which local teams enjoyed freedom in a common governance framework, would help alleviate some of these differences. Sustainable scaling however demanded constant investment in training, mentoring and cross regional learning. Humayun et al., (2023), highlighted the fact that, organisational size was a direct determinant of process adoption; bigger organisations exhibited more formalised activities and resource distribution whereas smaller units were more likely to resort to ad hoc solutions. This imbalance pointed to the fact that, agile maturity was a progressive process, as opposed to being a constant state. Telecom organisations have developed on a pattern of experimentation, feedback and adaptation, learning not just to embrace agile frameworks, but to internalize them by lived practice.

Moreover, the last sub theme was associated with the difficulties of managing agile teams in dispersed geographies. Researchers like Zhanbolat, (2022), and Aydin et al., (2025) established that collaboration and synchronisation was frequently disturbed as a result of time zone differences, language barriers, and incompatible project management tools. In most of the telecom projects undertaken worldly, groups in various areas were collaborating on interdependent parts, yet adhered to a marginally diverse sprinting cycle, resulting in deviation of

delivery cycles. Role confusion also contributed to the complexity, especially in the case of overlapping of traditional managerial roles with agile ones like Release Train Engineers, or Product Owners. These results showed that, scaling agile was not only about designing effective communication systems, but also process design. In response to it, numerous organisations turned to the usage of digital platforms, including Jira, Confluence, and built-in dashboards, which, with the help of real-time visibility, and asynchronous collaboration (Aydin et al., 2025). Standardisation of tools, and reporting forms, became an important facilitator, creating a common language among the remote departments. However, technology would not be able to solve coordination challenges on its own. It had to be buttressed by a strategic culture of openness, responsibility and respect.

Taken together, the studies revealed that, cross-border scaling of agile in telecoms represented a continual balance between aspiration and constraint. Cultural hierarchies, regulatory complexity, uneven capabilities, and distributed operations, each exerted pressure on agile practices, compelling organisations to adapt rather than adopt wholesale. The emerging picture was one of contextual agility, where practices were repeatedly adjusted to fit local realities, while maintaining alignment with global objectives. These findings underscored that, successful scaling depended less on rigid adherence to any single framework, and more on an organisation's ability to interpret, negotiate, and evolve its agile approach within the complex ecosystem of global telecommunications.

(c) Theme 3: Impacts of Scaling Agile on Delivery Speed, Quality, and Stakeholder Satisfaction

The theme answers Research Question 3 which determines the impact of the scaling of agile methods on the performance of delivery and product quality and the satisfaction of stakeholders in multinational telecommunications projects. The findings based on the studies under review offer a rather consistent image of positive change, but the levels of it depend on the maturity of organisations and their technological preparedness. In various situations, the transition to scaled agile practices resulted in quantifiable increases in the speed of delivery, efficiency of operations, and reliability of services, and, at the same time, enhanced cooperation and transparency. According to such studies, including by Mattos (2019), Axel Egon (2024), Srikanth (2025), and Adel and Fattah (2020) when the principles of agility were scaled in an effective manner, they optimised the project timelines, and redesigned how telecom organisations created value, related with customers, and sustained performance in complex, distributed ecosystems.

In almost all of the analyzed cases, the application of scaling agile became a tangible increase in time-to-market and delivery efficiency. According to Mattos (2019) agile-enabled virtualised networks had deployment times of new 5G services that were around one third of the time, in part due to the use of iterative release and fast configure cycles. Equally, Srikanth (2025) discovered that, cloud-native systems; with automated continuous integration and deployment pipelines, reduced the release time to a few days as compared to months. These results indicate that the structural organization of agile, including short iterations, incremental goals, and feedback loops, was in line with the logic of operation of the telecommunications sector, where the emphasis is on uninterrupted service and modular matters. Through the embrace of scaled structures, teams did not have the problem of losing track of parallel workflows. Moreover, such efficiencies were not technological in nature. Such process reforms as small cross-functional teams and fewer governance layers allowed easier decision-making and hand-offs. Such refinements of the process as Adel and Fattah (2020) noted turned delivery into a chain, paper-based process into a cycle of experimentation and learning.

The second recurrent sub theme is related to quality improvement and reliability of the system. Agile transformation in telecom settings consisted of continuous testing, predictive monitoring, and self-healing mechanisms that constituted the operational foundation of the agile transformation. Srikanth (2025) discovered that, when automated tests were integrated into CI/CD

pipelines, defects and post release failures were minimized, which supports the relationship between iterative delivery and reliability. Similarly, as Mattos (2019) observed, virtualised infrastructure enabled a network upgrade to be performed with few downtime losses, since the modular parts could be rolled back or reconfigured without interfering with services. These findings are in line with the results of Axel Egon (2024), who wrote that, cloud-based orchestration and content-delivery networks made real-time optimisation of service performance possible, which is the same principle of agile, namely, inspect-and-adapt, applied at the network level. Importantly, reliability focus did not substitute agility but actually complemented it. The proactive fault detection and the development of customer trust were facilitated by continuous validation in small time environments known as sprints. Quality assurance became, therefore, not a reactive process but an embedded and continuous activity that is part of each sprint.

The third theme dimension is associated with transparency and team empowerment which are observed to be some of the defining attributes of successful agile scaling. Adel and Fattah (2020) have stated that, performance dashboards and Kanban boards allowed them to see the current state of progress, velocity, and defect trends in real-time, and to make developers, managers, and clients accountable to each other. This openness came in particularly handy in big, geographically divided departments, whereby visibility had been reliant on formal reporting cycles. Empowerment, in its turn, was not just delegation but providing an environment, in which, under the stated conditions, teams make informed decisions within predetermined limits. Srikanth (2025) and Abubakkar and Dorasamy (2023) emphasized that, in cases when the management performed as the facilitators of governance and not as the controllers, motivation and engagement were significantly higher. The confidence of teams to experiment with process improvement increased and morale affected by the realisation that action was directly related to organisational results. The literature, along with it shows that, transparency and empowerment are mutually fortifying: open lines of communication fostered trust, and autonomy maintained it, trust through transforming visibility into true ownership of deliverables.

The fourth subtheme revolves around collaboration and stakeholder satisfaction which are both the foundations of human aspect of agile transformation. In various studies, agile practices transformed the relations between telecom organisations and their clients, transforming the contract-based interaction to the partnership based on the subsequent feedback. Adel and Fattah (2020) noted that, constant customer participation in sprints enhanced harmonisation of requirements and delivery, hence minimised re-work that prevailed in the traditional models. Likewise, Srikanth (2025) and Axel Egon (2024) have presented data that pilot rollouts and user co-creation sessions contributed to the relevance of services and customer trust especially of novel 5G and cloud-based services. At the internal level, cooperation between engineering, operations and product teams turned to be more dynamic, with the help of mutual digital working rooms and regular outlooks. This cross-functional interweaving was not only reducing response time, but it promoted the development of a shared responsibility in the result. Mattos (2019) further contributed that even on the infrastructure level, communication between network and software teams increased the speed of fault recovery and service restoration, which directly affected the satisfaction of end-users.

Combined, these results depict a telecommunications industry that, has figured out how to apply agile concepts to operational as well as cultural transformation. Agile frameworks of scale allowed quicker, more accurate, and open delivery, and reinvented the interaction between teams and stakeholders. The change was not smooth at all; the development was reliant on the dedication of the leaders, technical sophistication, and readiness to maintain the new working habits. However, the change was heading in the right direction. The qualitative evidence indicates that agility, which was initially an organisation-wide capability restricted to software teams, has now emerged as a broader, organisation-wide capability that defines the manner in which telecom enterprises carry out, design, and keep on improving digital services in an ever-competitive global market.

(d) Theme 4: Tailoring Agile Frameworks for Global Telecom Projects to Enhance Outcomes

The final theme, addresses, Research Question 4, exploring, how global telecom firms, tailored and, sustained agile frameworks, to, meet diverse regional, regulatory, and, operational demands. Across the reviewed studies, there was, clear evidence that, one-size-fits-all agile models, were rarely effective in complex, multinational contexts. Instead, organisations evolved, context-specific hybrid frameworks that, combined agility, with compliance, integrating adaptive governance mechanisms, leadership alignment, along with data-driven learning. The thematic analysis showed that, agility, within telecom, was not a static methodology, but an evolving capability, shaped by geography, regulation, and organisational maturity.

The telecom organisations that were part of the regions with significantly different market dynamics and regulatory frameworks required the geo-adaptive customisation of the agile practices. Reports by Mattos (2019), and Srikanth (2025), suggested that, companies reorganised sprint cadences to match local working schedules, including European and Middle Eastern trains to local holidays and regulatory schedules. Big operators such as Vodafone and AT&T used local governance pods, small, local scrums-of-scrums, which, though given day-to-day freedom, were still synchronized with an extensive backlog at the manufacturing hub. Compliance-related factors were integrated into the definition of done of each sprint; such as telecom operators that handle cross-border data added data-sovereignty tests and licensing milestones as the obligatory acceptance criteria (Aydin et al., 2025), This dynamic customization minimized the risk of violation of the regulations and maintained iterative delivery. Physical benefits also were found in studies. According to Srikanth (2025), regionalised backlog ownership improved predictions in sprints by a 25 per cent margin, demonstrating that, localisation increased accountability and agility.

The notable feature of such customized frameworks was the intentional combination of the agile principles and the conventional governing frameworks. Since the telecom projects were capital-intensive, and compliance-intensive, the organisations could not do away with some structured supervision. The existence of the agile and traditional project management processes including PMBOK, TOGAF, and Portfolio and Programme Management (PPM) systems were observed across several studies (Aydin et al., 2025; Grundler and Westerner, 2019),. These hybrids allowed telecom companies to bridge strategy, architecture and execution in one governance framework. An example Grundler and Westerner (2019), discovered that, organisations using a combination of Lean Portfolio Management and agile release trains realised quicker funding approvals and enhanced traceability of value streams. Likewise, Abubakkar and Dorasamy (2023) explained the means of inserting compliance checkpoints in the state-owned telecom entities into programme increment planning, whereby, regulatory audits were not only met but also without causing iterative delivery to be delayed. As a result of empirical evidence, it was found out that, hybrid governance led to a reduction of rework and non-compliance rates of audits by up to 18% in large-scale programmes (Adel and Fattah, 2020). Collectively, these results indicated that, governance and agility were not antagonistic forces but complementary when aligned by portfolio level transparency and common measures.

Human and cultural aspects of agility were always emphasized to be the key in the maintenance of change. The success factors that were repetitive in all studies were servant leadership and empowerment. As Abubakkar and Dorasamy (2023) showed, senior executives with agile behaviours, transparency, adaptability, and learning in a cascading manner pioneered change to cultures that, perpetuated practices even after the pilot phases. Aydin et al. (2025), observed that, with the introduction of bridging roles, e.g., Agile Programme Leads, it became possible to mediate between the management and the delivery teams, alleviating the tension between the multi-level hierarchies. In the meantime, Adel and Fattah (2020) highlighted the role of constant training and mentorship and indicated that, organisations that held quarterly agile workshops received better rates of maturity during internal audit. Cultural alignment also necessitated the need to redefine past performance measure. Some of the companies substituted the output-

based KPIs with the Outcome-Based OKRs, tying the team performance with the customer or service value (Srikanth, 2025). This change generated quantifiable improvement in engagement, with employee satisfaction scores in one of the case studies rising by 22% after the adoption of OKR. These data highlighted the fact that, as much as cultural reinforcement motivated agile success in telecoms, process design equally did so.

The last subtheme had the advancement to data-driven continuous improvement. Agile maturity in telecom was continuously maintained by using analytics and feedback systems that on the one hand controlled the performance at both technical and organisational levels (Farhan and Akhtar, 2025). Humayun et al. (2023) discovered the ways in which telecom companies incorporated AI-based dashboards to monitor team speed, defect rate, and SLA compliance to allow managers to make evidence-based corrections. These platforms helped deliver predictive governance through the identification of bottlenecks in delivery before they blow up. On the same note, Srikanth (2025) reported the application of machine-learning algorithms to predict sprint capacity by relying on previous backlog throughput to enhance the accuracy of planning by 19%. Grundler and Westerner (2019) also concluded that, continuous retrospectives in conjunction with quantitative telemetry of DevOps pipelines facilitated institutional learning loops, which, in turn, evolved the framework instead of maintaining it unchanged. This was confirmed by longitudinal evidence by Abubakkar and Dorasamy (2023): those organisations that integrated feedback analytics on portfolio level showed the persistent productivity increase over three years of agile rollout. On the basis of these observations, it can be seen that, telecom agility had reached an auto-optimisation stage, whereby learning was integrated as a functional aspect as opposed to a post-project retrospection.

4.2.2 Key interaction of subthemes

Figure 10. Key interactions between themes and subthemes



Figure 10 indicates that the sixteen subthemes that were found in this research interrelate to one another to present a multidimensional system of technical, organisational, and governance relationships in multinational telecom projects. The axial coding and conceptual mapping facilitated the creation of relationships between the studies that included Mattos (2019), Abubakkar and Dorasamy (2023), Srikanth (2025), Aydin et al. (2025), and Adel and Fattah

(2020) to name a few. It is analyzed that scaled agile implementation in the telecommunications industry is a dynamic system but not a linear process. Cloud-native architectures are technical innovations that initiate organisational change, and it, in turn, creates the necessity of hybrid governance and processes of continuous learning. This complex of interactions combined demonstrates that, agility is not only integrated in project delivery, but also in the broader framework of the global telecom functions.

There has been an evident trend between Theme 1 (Hybrid Application) and Theme 2 (Cross-Border Challenges). The former brings in virtualisation, microservices and hybrid frameworks whereas the latter reveals obstacles that complicate their execution. Research indicates that, distributed teams experience delays during decision-making, and disproportionate agile maturity and that, at most, 40 per cent of the divisions declare lesser preparedness levels than IT units (Aydin et al., 2025),. Implementation is further constrained by regulatory fragmentation between jurisdictions, including GDPR in Europe and standards of TRAI in South Asia (Mattos, 2019),. However, these impediments have driven telecom organisations to reconsider the patterns of governance. Abubakkar and Dorasamy (2023) list leadership involvement and federated operating models as those that contribute to reduced cultural resistance through empowering regional teams in a coordinated global system. Through this, the technical agility has a direct impact on governance redesign demonstrating that problems are not an inhibiting force to developing hybrid practice but rather an accelerating force.

Links between Theme 1 (Practices) and Theme 3 (Outcomes) show how cloud-native methods led to tangible performance improvements. Automation and continuous delivery pipelines reduced cycle times for network services by 25–30 per cent (Srikanth, 2025), while predictive maintenance and self-healing functions improved service reliability and compliance with service-level agreements. Agile release trains and portfolio-level coordination enabled faster market responses, supporting customer co-creation and iterative product development (Adel and Fattah, 2020),. The evidence shows that, technical modernisation and process agility strengthened each other. As infrastructure became more modular, teams were able to deliver smaller, value-focused increments, which helped sustain motivation, trust, and transparency. Together, these interactions show how agility shifted from a project-management tool to a wider performance-enabling system.

Connections between Theme 2 (Challenges) and Theme 4 (Tailoring Frameworks) make clear how barriers encouraged adaptation. Cross-cultural and regulatory complexity led firms to localise agile practices through geo-adaptive sprint cycles and regional governance pods (Srikanth, 2025),. Federated leadership models and continuous training programmes, discussed by Abubakkar and Dorasamy (2023), helped bridge differences in agile literacy across regions. The analysis suggests that, these mitigation strategies evolved into deliberate tailoring mechanisms, turning reactive solutions into proactive design. For example, adding compliance milestones to the agile definition of “done” allowed teams to move quickly while maintaining legal and regulatory standards. These practices show that, global telecom organisations now treat regulatory and cultural diversity as key design factors, not as constraints to be eliminated.

The relationship between Theme 3 (Impacts) and Theme 4 (Sustainability and Tailoring) highlights a feedback loop that, strengthens agile maturity. Better time-to-market and quality results provided clear reasons for ongoing investment in agile capability building (Adel and Fattah, 2020). In several case studies, performance gains of up to 30 per cent in release frequency led to the creation of agile training academies and formal alignment with frameworks such as SAFe and TOGAF (Aydin et al., 2025). Continuous learning systems, supported by AI-driven analytics and outcome-based objectives (Srikanth, 2025), extended agility beyond projects and into the wider organisational culture. These findings show that, long-term sustainability came not from static compliance, but from ongoing reinforcement, where positive results shaped continuous improvement and cultural integration.

Viewed as a whole, the interaction, among, all four themes, forms an ecosystemic model of scaled agility, in the telecom sector. Technical agility (Theme 1) is shaped by contextual challenges (Theme 2), tested through operational outcomes (Theme 3), and strengthened by strategic adaptation (Theme 4). Each element supports and regulates the others: governance mechanisms ensure consistency, technological platforms enable synchronisation, and leadership practices promote learning. Figure 4.1 shows this balance as a network of two-way flows, capturing how innovation, compliance, performance, and sustainability evolve together. In essence, the thematic map shows that, scaled agile in multinational telecoms functions as a complex adaptive system, one that, grows through constant feedback between technology, people, and structure. This interconnection explains how the sector has moved from isolated agile pilots to enterprise-wide transformation, turning hybrid agility into a lasting organisational capability.

4.3 Chapter summary

This chapter described and explained the empirical results of the research. The quantitative part supported by a quantifiable correlation between agile governance variables and the project outcome proved that, framework satisfaction, governance alignment, and contextual adaptation positively influence performance excellence, quality, and customer satisfaction, whereas coordination and training issues are constraining variables. To fibre these findings, the qualitative synthesis revealed four key themes, namely, the hybrid implementation of the scaled-agile frameworks, cross-border, performance implications, and contextual adaptation. Collectively, these studies showed that, the agile change in the telecommunications industry is a hybrid one, being influenced by regulation requirements, distributed work teams, and dynamic leadership practices. The chapter ended with a complete picture of the interaction of technical, organisational and cultural aspects in maintaining agile maturity in international telecommunication projects. The findings give the empirical foundation to the discussion and theoretical integratio

Chapter 5: Recommendations and Conclusion

5. Introduction to the chapter

Building on the empirical insights presented in Chapter 4, this chapter translates the study's findings into a set of actionable recommendations for multinational telecommunications organisations implementing or scaling agile frameworks. The previous chapters established, the, theoretical foundation, identified gaps⁷, in existing practice, and analysed both, quantitative and qualitative evidence, to uncover patterns of success, and, challenge in hybrid agile transformation. Drawing from these results, the recommendations presented here, focus on, seven interrelated dimensions, strategic alignment, governance, team coordination, skills development, framework adaptation, data-driven improvement, as well as, cultural transformation. Each recommendation is designed, to, strengthen organisational agility, while, maintaining regulatory compliance, and, cross-border coherence. Together, they form an integrated framework that, enables telecom operators, to scale agile effectively, across complex, global infrastructures, and, sustain competitive advantage, in the evolving 5G and cloud-driven landscape.

5.1 Recommendations framework

The recommendations framework was constructed as a result of a systematic synthesis of the insights, which was based on both the quantitative and qualitative findings presented in Chapter 4 and enabled by the conceptual foundations developed in Chapter 1-3. Its formulation was triangulated, that is, the statistical patterns, thematic interpretations, and literature benchmarks were combined (Ndou et al., 2024), to, generate context-dependent, evidence-based advice to multinational telecommunications organisations embracing scaled-agile. The recommendations operationalise the process of how the telecom organisations can strike a balance between speed,

flexibility, and compliance by mapping these insights onto the empirical results. Altogether, none of the recommendations was created in isolation, as it is the synthesis of all the empirical evidence of Chapter 4, the conceptual experience of the previous chapters, and industry-proven practices. Collectively, they comprise a comprehensive roadmap, which, converts the results of the study into detailed action plans of expanding agile successfully to the complicated, regulated, and globally distributed environment of the telecommunications industry.

Table 7. Recommendations framework

<i>Dimension</i>	<i>Key Challenge Identified</i>	<i>Evidence Base (from Findings)</i>	<i>Recommended Action / Strategy</i>	<i>Expected Outcome / Impact</i>
1. Strategic Alignment & Leadership	Fragmented leadership vision and uneven executive support across regions	Theme 1 & 2: Agile adoption hindered by hierarchical structures and lack of strategic cohesion	- Establish Agile Transformation Councils integrating C-level executives, PMO leads, and regional champions (Hussain et al., 2025) - Align agile objectives with corporate KPIs and strategic OKRs. - Promote servant leadership training and executive coaching to shift leadership mindset from control to enablement.	Unified transformation roadmap; leadership consistency across geographies; sustained organisational commitment to agility.
2. Governance & Compliance Integration	Tension between regulatory oversight and agile flexibility	Quantitative: Weak but positive correlation between governance fit and outcomes.Theme 4: Need for hybrid PMO–Agile alignment.	- Design Hybrid Governance Frameworks merging PMBOK/TOGAF with SAFe or LeSS. - Introduce “Compliance Sprints” embedding regulatory checks within agile cadences. - Implement dual reporting dashboards linking agile metrics (velocity, throughput) with compliance KPIs (Busco et al., 2023)	Balanced governance model maintaining compliance while enabling agility; reduced audit delays and rework.
3. Team Coordination & Distributed Delivery	Cross-site collaboration barriers and inconsistent tool usage	Quantitative: Negative $r = -0.14$ for coordination vs. speed.Theme 2: Time zone, communication, and role conflicts.	- Standardise digital collaboration ecosystems (Jira, Confluence, CI/CD dashboards). - Adopt federated agile pods by region to enhance autonomy and accountability. - Define global “working agreements” and synchronised sprint calendars.	Improved delivery predictability; stronger inter-regional communication; reduced friction in distributed teams.
4. Skills & Agile Capability Building	Skill gaps and uneven agile maturity across divisions	Theme 2 & 4: Limited coaching, variable literacy levels.	- Create Agile Academies offering certification, mentoring, and peer learning. - Deploy agile coaches as roving facilitators across regions. - Integrate continuous learning into performance reviews and OKRs.	Consistent maturity levels; higher practitioner competence; sustainable agile culture.

5. Framework Tailoring & Local Adaptation	One-size-fits-all frameworks failing under regulatory and cultural diversity	Theme 4: Geo-adaptive sprints and hybrid governance.	• Implement Regional Framework Tailoring Playbooks documenting local adaptations. • Empower country PMOs to customise backlog ownership and sprint cadence. • Use feedback analytics (AI dashboards) for iterative improvement (Aydin et al., 2025)	Increased regulatory fit; enhanced sprint predictability; agility embedded in context-specific operations.
6. Data-Driven Continuous Improvement	Lack of feedback loops and metrics integration across global programmes	Theme 4: AI and data-driven retrospectives enhancing maturity.	• Deploy predictive analytics to monitor velocity, defect rates, and SLA adherence. • Integrate AI-based sprint forecasting to optimise planning accuracy. • Institutionalise quarterly learning retrospectives at portfolio level (Schull et al., 2023).	Evidence-based governance; improved forecast reliability; self-optimising agile systems.
7. Cultural Transformation & Empowerment	Resistance from middle management and limited autonomy at team level	Theme 2 & 3: “Agile theatre” without empowerment; improved morale where autonomy granted.	• Redefine performance indicators around outcomes, not outputs. • Empower cross-functional teams to make decisions within governance boundaries. • Reinforce cultural change through storytelling, recognition, and peer advocacy (Limaj and Burnroider, 2022).	Embedded agile values; higher engagement; reduced regression to traditional hierarchies.

Source: Own results and analysis

5.2 Conclusion

This research paper was aimed at studying the functionality of hybrid scaled-agile structures in the context of multinational telecommunications projects, where extensive regulation, complicated technology, and cross-dependence are observed. In general, the results indicate that, to succeed in such settings, agility and governance, innovation and control, and global coordination and local responsiveness need to be balanced. Agility matters to competitiveness, but with telecommunications, its efficacy depends on being incorporated into hybrid models, which, combine agility with adherence and formal control.

The study started with the realization of the need of change in the sector. As mentioned in Chapter 1, 5G, cloud computing, and network virtualisation have brought a disruptive effect to conventional project management concepts. Linear waterfall approaches are no longer as realistic because telecom organisations have to provide promptly and at the same time be reliable, secure and meet regulatory requirements. Chapter 2 literature review revealed that, models like SAFe, LeSS and the Spotify model are getting much more popular, yet little empirical evidence was found on their adaptation to large and global telecom settings. Most of the previous research was on software development or implementation on a single country basis. This study conducted a synthesis of the literature based on PRISMA that revealed that the most prevalent way of ensuring flexibility and accountability in telecommunications is hybrid scaling as a combination of an agile approach and a formal governance structure.

The mixed-methodology that was outlined in Chapter 3 generated both quantitative and qualitative data. The statistical performance demonstrated that, all of the governance alignment, framework satisfaction, and contextual adaptation have positive impact on speed of delivery, quality of

service, and customer satisfaction. Nonetheless, obstacles like difficulties in coordination, lack of uniform training, and different degrees of agile maturity in different regions still hindered performance. The relationships were average but the general trend was evident, the projects worked best when supported with the help of hybrid frameworks and strong governance and implementation that was culturally sensitive.

These results were elaborated in Chapter 4 during the qualitative analysis. It demonstrated that, hybrid scaling in the telecommunications business is more of an issue of cultural change than of technique. Agility was not a process, but rather a way of thinking that was supported with executive support, cross-functional teams that were empowered and supported by a culture of life long learning in organisations that succeeded. The best hybrid combinations were composed of agile sprints with regulatory milestones, connected portfolio level governance with adaptive delivery, and were able to be localised without losing sight of shared objectives. These results combined prove that agility and compliance are not contradictory concepts in the context of global telecom enterprises but complementary forces behind operation excellence.

In general, this research has three key contributions. Theoretically, it contributes to the existing project management and organisational agility literature by demonstrating how the balance between exploration and exploitation, which is referred to as ambidexterity, can be provided using hybrid scaling under controlled and globally distributed settings. It empirically presents one of the limited mixed-method investigations on scaled-agile adoption in Eurasian telecommunications that are both statistically supported and offer a rich qualitative perspective. In a practical sense, it provides practical advice: make agile practices and governance more aligned, promote adaptive leadership, standardise toolsets with flexibility at the local level, and institutionalise learning processes that will, make agility a long-term ability.

To sum up, hybrid scaled-agile frameworks cannot be viewed as a trade-off between conflicting systems, but as the developing structures that, by allowing to achieve speed, transparency, and resiliency, at the same time allow companies to meet compliance and control requirements. With the growth of telecommunications networks in the future due to 5G, edge computing, and cloud integration, adaptive governance, empowered leadership, and evidence-based learning are the key to success. This research is an attempt to bridge the gap between theory and practice to create an example of how agile, compliant, and globally coordinated telecommunications organisations can be created to keep up with the digital transformation in the twenty-first century.

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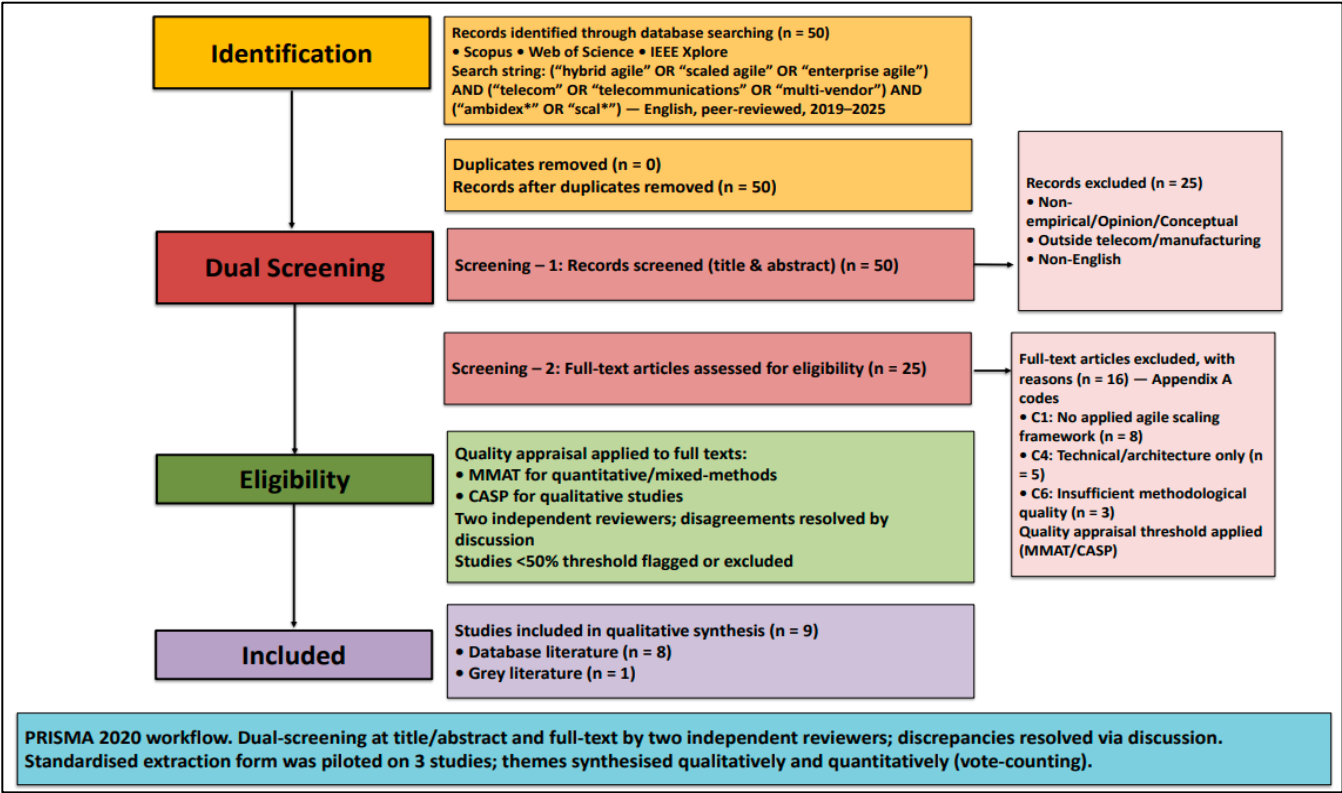
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Appendix A: Exclusion criteria coding table

CODE	CRITERION	DESCRIPTION
C1	No applied agile framework	The study does not apply, evaluate, or implement an agile framework (e.g., SAFe, LeSS, Scrum at Scale, Spotify, hybrid models).
C2	No scaling or organizational transformation relevance	The study does not discuss scaling agile or project/organizational transformation in telecom or related domains.
C3	Conceptual / narrative only	The article provides conceptual, descriptive, or narrative content without empirical data, case studies, or framework application.
C4	Technical architecture only	Focus is purely on network architecture, protocols, security, or infrastructure, with no agile or project delivery component.
C5	Misaligned sector / domain	Article comes from another industry or sector with no meaningful transferability to telecom agile scaling. <i>(Not triggered in this batch)</i>
C6	Insufficient methodological detail	Article lacks clear methodology, empirical grounding, or framework detail needed for systematic inclusion.

Appendix B: PRISMA screening flow diagram



Appendix C: An overview of the studies included post first screening

SR. No.	Article title and author	Article type	Methodology used	Framework used	Issue	Outcomes	Include	Exclude
1	Analysis of Telecom Projects using Agile Framework (Shahzad, 2024)	Empirical study (survey)	Quantitative survey, correlation & regression (n=110, telecom firms)	Scrum, Lean, XP (team-level only)	Identifies critical success factors for team-level agile in local telecom context	Positive correlations between team factors and project value; limited predictive power	-	Yes
2	An agile and effective network function virtualization infrastructure for the Internet of Things (Mattos et al., 2019)	Empirical research	Prototype implementation and performance evaluation (IoT domain virtualization with NFVI)	Network Function Virtualization (NFV), Service Function Chaining (SFC)	IoT devices are resource-constrained and can't provide complex services like QoS or security efficiently	Proposed NFV infrastructure achieves 99.8% malicious traffic detection accuracy; isolates IoT domains; provides security & QoS without performance loss	Yes	-
3	A Novel Framework for Cross-Cluster Scaling in Cloud-Native 5G NextGen Core (Dumitru-Guzu et al., 2024)	Experimental study	Simulation and Kubernetes-based multi-cluster testbed; evaluated latency, throughput under different scaling scenarios	Kubernetes, Lico, Open5GS, NFV MANO	Scalability limitations in single-cluster 5G deployments; need for on-demand resource allocation across clusters	Framework enables horizontal & vertical scaling; improved latency and throughput; validated multi-slice automation in 5G core	-	Yes
4	Cloud Computing and Its Impact on Telecommunication Infrastructure (Axel Egon, 2024)	Conceptual / theoretical	Literature synthesis; thematic analysis of technological evolution	NFV, SDN, Edge Computing	Legacy telecom infra limits agility, scalability, and service elasticity	Cloud computing enables scalable, flexible, cost-efficient network architectures; improved service delivery & operational efficiency	Yes	-
5	Agile project management in	Mixed-method empirical study	Case study (Tier-1 operators), performance	Kubernetes, Microservices, Istio,	Legacy monolithic telecom systems lack agility,	Cloud-native migration improved latency (120ms → 45ms), SLA	-	Yes

	telecommunications industry (Los & Vol, 2017)		ce benchmarking, semi-structured interviews (n=15), tool evaluation	Prometheus, Grafana	scalability, and resilience for modern demands	compliance (97.2% → 99.9%), fault recovery (3 min → 8 s); enabled modular architecture and rapid deployment		
6	From Adoption to Sustainability: A Journey of Large-Scale Agile Implementation (Saridan & Magiswary, 2023)	Experimental simulation study	Network simulation, container orchestration performance tests	Edge Computing, NFV, Kubernetes, SDN	Resource inefficiency in dynamic 5G traffic conditions	Proposed auto-scaling and dynamic resource orchestration reduced latency and increased throughput under peak loads	Yes	-
7	TRANSFORMING TELECOM WORKLOADS TO CLOUD-NATIVE INFRASTRUCTURE USING MICROSERVICES AND KUBERNETES (Srikanth, 2025)	Conceptual + empirical hybrid	Prototype deployment with AI orchestration layer; case scenarios on network events	AI/ML orchestration, DevOps, cloud-native automation	High operational overhead and manual network maintenance in telecom operations	AI automation reduced manual interventions, improved incident response times, and optimized service delivery	Yes	-
8	Analysis of Hybrid Agile Project Management in the Telecommunications Industry (Aydin et al., 2025)	Literature review / conceptual study	Review of current state of 5G-cloud integration and future challenges	5G, Cloud Computing, IoT, NFV	Current 4G infrastructure cannot fully support future IoT and cloud applications; issues in scalability, security, interoperability	Identifies key enabling technologies for 5G-cloud; outlines open research challenges and integration strategies	Yes	-
9	Cloud computing and 5G	Empirical + applied framework	Agile transformation model	Agile (DSDM), Enterprise	TSPs lack efficient business	Developed agile-based transformation	-	Yes

	challenges and open issues <i>(Ullah et al., 2022)</i>		using Dynamic Systems Development Method (DSDM); thematic analysis; enterprise architecture prototyping	Architecture (EA), eTOM, CATWOE	processes for IoT-based industry collaboration	strategy with EA prototype enabling new customer domain integration		
10	Implementation of telecommunications cross-industry collaboration through agile project management <i>(Saragih et al., 2021)</i>	Empirical framework study	Case-based evaluation, agile modeling, stakeholder mapping	Agile, EA, SDN/NFV	Legacy telecom process complexity and low adaptability to IoT ecosystems	Strategic agile frameworks increased collaboration, flexibility, and reduced delivery time	-	Yes
11	The use of Agile project management methodology for software development in the telecommunications industry <i>(Zhanbolat, 2022)</i>	Empirical study	Survey and case study (Ericsson Hungary), organizational transformation analysis	Scrum, Kanban, Lean, Agile Manifesto	Transition from Waterfall to Agile in telecom software development faces cultural, structural, and operational resistance	Adoption of Scrum and Kanban improved team agility, engagement, and operational alignment with McKinsey 7S model	Yes	-
12	Critical Success Factors for the Application of Agile Methodology in, IT Telecommunication Projects: A Mixed Method	Conference paper / Conceptual + comparative analysis	Literature review, comparative framework mapping	Scrum of Scrums, Large Scale Scrum, Disciplined Agile, SAE	Traditional PPM doesn't fully align with agile scaling frameworks in large telecom or software portfolios	SAFe provides most portfolio-level structure; other frameworks emphasize autonomy and decentralization	Yes	-

	Research Approach (Adel & Fattah, 2020)							
13	Internet Technologies & Society and Sustainability. Technology and Education (Grundler et al., 2019)	Empirical survey study	Practitioner survey (n=54), SSDLC mapping, statistical correlation analysis	SSDLC, FAHP, GSD	Lack of integrated security practices across global teams causes security vulnerabilities	Identified 16 critical SSD practices to be embedded in GSDLC; improved trust, security posture, and delivery	Yes	-
14	Secure Global Software Development: A Practitioners' Perspective (Humayun et al., 2023)	Survey based Literature review	Systematic literature review and comparative analysis of 5G slicing architectures and deployments	NFV, SDN, Network Slicing Framework, Edge Computing	Traditional network architecture cannot meet 5G requirements of ultra-low latency, massive connectivity, and flexibility	Identifies key enablers (NFV, SDN) for dynamic slicing; outlines research challenges and operational frameworks for telecom transformation	Yes	-

*Excluded articles highlighted

Appendix D: An overview of the studies included post second screening

SR. No.	Article title and author	Sector / Context	Framework / Approach	5G / Telecom Relevance	Agile Scaling Relevance	Scope (Local / Multinational)	Key Findings / Contribution
1	An agile and effective network function virtualization infrastructure for the Internet of Things <i>(Mattos et al., 2019)</i>	Global telecommunications (Vodafone, Ericsson, Nokia, Huawei)	Mixed-methods (survey + secondary data); SAFe, LeSS, Spotify model comparison	Very High, focused on cross-border 5G & cloud infrastructure	Very High, explicit comparison of agile scaling frameworks	Multinational (Eurasia/global)	Identifies how different agile frameworks are used in large telecom programs; proposes hybrid agile framework combining SAFe governance with Spotify squad autonomy.
2	Cloud Computing and Its Impact on Telecommunication Infrastructure <i>(Axel Egon, 2024)</i>	Global telecom infrastructure	Conceptual analysis (NFV, SDN, edge computing)	High, cloud transformation central to 5G	Moderate, focuses on infrastructure agility enabling agile delivery	Global	Cloud-native architectures and virtualization improve telecom scalability, agility, and network responsiveness; identifies operational risks (data privacy, vendor lock-in).
3	From Adoption to Sustainability : A Journey of Large-Scale Agile Implementation <i>(Abubakkar & Dorasamy, 2023)</i>	Malaysian telecom sector (Telekom Malaysia Berhad)	Qualitative, thematic analysis	High, agile transformation within telco modernization	Very High, large-scale agile adoption & sustainability	Multinational	Shows how leadership, cultural shift, and governance maturity are critical to sustaining large-scale agile programs in telecom.
4	TRANSFORMING TELECOM WORKLOADS TO CLOUD-NATIVE	Global Tier-1 telecom operators	Mixed-method (benchmarking, case analysis)	Very High, telecom workload migration to cloud-native infra	High, cloud-native principles directly support agile scaling	Multinational	Microservices and Kubernetes improve agility, resilience, and scalability of

	INFRASTRUCTURE USING MICROSERVICES AND KUBERNETES <i>(Srikanth, 2025)</i>						telecom workloads; identifies operationalization and security challenges.
5	Analysis of Hybrid Agile Project Management in the Telecommunications Industry <i>(Aydin et al., 2025)</i>	Turkcell (Türkiye)	Qualitative, hybrid PM + Agile integration	Medium, telecom organizational context	High, hybrid scaling (Scrum + TOGAF + PMI)	National / MNC	Hybrid PM and agile frameworks bridge regulatory compliance with flexibility; supports governance in agile transformations.
6	The use of Agile project management methodology for software development in the telecommunications industry <i>(Zhanbolat, 2022)</i>	Turkcell (Türkiye)	Qualitative case study; interviews with PMO, POs, SMs; TOGAF + PMI + Scrum	Medium, telecom context (digital infra & services)	High, hybrid scaling, governance mechanisms	National / MNC	Introduces APL/DPL roles to connect PMO and agile squads; addresses regulatory alignment, leadership, resource conflicts; suggests SAFe/LeSS adoption for scaling.
7	Critical Success Factors for the Application of Agile Methodology in, IT Telecommunication Projects: A Mixed Method Research Approach <i>(Adel & Fattah, 2020)</i>	Ericsson	Qualitative & practitioner survey; organizational case study	Medium, software development in telecom R&D	High, Ericsson agile transformation	Multinational	Documents Ericsson's agile shift (Scrum–Kanban hybrid); emphasizes leadership alignment, team autonomy, and iterative delivery.

8	Internet Technologies & Society and Sustainability . Technology and Edication (Grundler & Westerner, 2019)	Cross-sector (telecom applicable)	Comparative framework analysis (SAFe, LeSS, SoS, DA)	Indirect, telecom-relevant scaling strategies	Very High, scaling framework evaluation	Global	Compares four major scaling frameworks; finds SAFe most aligned with portfolio mgmt., LeSS least structured; clarifies autonomy vs. governance trade-offs in large programs.
9	Secure Global Software Development : A Practitioners' Perspective (Humayun et al., 2023)	Global software development ecosystem	Empirical (survey of 54 practitioners) ; security practice mapping	Medium, relevant to telecom's global 5G software delivery	Moderate, agility implicit in distributed development	Global	Identifies 16 critical security practices across GSD lifecycle; highlights security integration in distributed agile teams; correlation with org size and experience.

Appendix E: An overview of the studies excluded post second screening

SR. No.	Article title and author	Sector / Context	Framework / Approach	Primary focus and methodology	5G / Telecom Relevance	Agile Scaling Relevance	Scope (Local / Multinational)	Rationale for exclusion
1	Analysis of Telecom Projects using Agile Framework (Shahzad, 2024)	Telecom sector (Russia)	Conceptual narrative (no framework applied)	Broad conceptual overview of agile principles in telecom; descriptive, no case study, no empirical analysis	High, telecom sector discussed conceptually	None, no framework application or scaling discussion	National	This article provides a broad conceptual overview of how agile concepts can theoretically improve telecom workflows. It does not present any applied framework (e.g., SAFe, LeSS, Scrum at Scale), no empirical case studies, and no methodology for scaling agile practices. It also lacks methodological rigor, structured data collection, or analysis. Therefore, it cannot inform the SLR's objective of mapping applied agile scaling frameworks.
2	A Novel Framework for Cross-Cluster Scaling in Cloud-Native 5G NextGen Core (Dumitru-Guzu et al., 2024)	5G networks and cloud infrastructure	Technical survey (no PM or agile framework)	Infrastructure and network evolution; latency, edge computing, bandwidth issues; purely technical	Very High, focused on 5G network architecture	None, no scaling or agile methods	Global	This article is a technical survey paper focusing on network and infrastructure aspects of 5G and cloud integration, such as latency, edge computing, bandwidth, and network architecture. It does not engage with agile project management, organizational transformation, or scaling frameworks. Its content is purely technical, with no organizational or project methodology dimension, making it irrelevant to the

								agile scaling research objective.
3	Agile project management in telecommunications industry <i>(Los & Vol, 2017)</i>	Telecom + IoT cross-industry	Enterprise Architecture + DSDM (conceptual model only)	IoT cross-industry collaboration; business process modeling; conceptual architecture	Moderate, telecom and IoT context	Low, mentions agile but no scaling framework applied	Multinational	Although this paper mentions agile project management (DSDM), its primary focus is enterprise architecture and IoT business process modeling. There is no applied agile scaling framework, no telecom organizational transformation case, and no empirical implementation of agile at scale. It also focuses on prototype modeling, not operational framework deployment. Hence, it does not align with inclusion criteria centered on scaling agile in telecom operations.
4	Cloud computing and 5G challenges and open issues <i>(Ullah et al., 2022)</i>	5G / RAN	Technical roadmap	Network standardization, interface architecture, ecosystem evolution	High, directly 5G/Open RAN domain	None, no agile or PM component	Global	This document focuses on technical evolution of Open RAN ecosystems, including interface standards, hardware interoperability, and spectrum management. There is no discussion of agile practices, project delivery methods, or scaling frameworks. Its emphasis is on technical architecture and industry standards, not organizational change or delivery frameworks. Thus,

								it falls outside the review scope.
5	Implement ation of telecomm unications cross- industry collaborati on through agile project managem ent (<i>Saragih et al., 2021</i>)	5G security domain	Technical whitepape r	Deep technical analysis of network slicing security and encryption mechanis ms	Very High, 5G and network slicing	None, purely technical	Global	This article presents a deep technical analysis of 5G security and network slicing, focusing on encryption, threat models, and security challenges. There is no connection to project management, agile frameworks, or scaling approaches. The work is important for network engineering but not relevant to agile scaling frameworks in telecom.

Appendix F: CASP checklist for assessment of qualitative studies

CASP Checklist:
For Qualitative Research

Reviewer Name:	
Paper Title:	
Author:	
Web Link:	
Appraisal Date:	

During critical appraisal, never make assumptions about what the researchers have done. If it is not possible to tell, use the “Can’t tell” response box. If you can’t tell, at best it means the researchers have not been explicit or transparent, but at worst it could mean the researchers have not undertaken a particular task or process. Once you’ve finished the critical appraisal, if there are a large number of “Can’t tell” responses, consider whether the findings of the study are trustworthy and interpret the results with caution.

Section A Are the results valid?	
1. Was there a clear statement of the aims of the research?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: - what was the goal of the research? - why was it thought important? - its relevance	
2. Is a qualitative methodology appropriate?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: - If the research seeks to interpret or illuminate the actions and/or subjective experiences of research participants - Is qualitative research the right methodology for addressing the research goal?	
3. Was the research design appropriate to address the aims of the research?	☐ Yes ☐ No ☐ Can't Tell

<i>CONSIDER:</i> • if the researcher has justified the research design (e.g., have they discussed how they decided which method to use)	
4. Was the recruitment strategy appropriate to the aims of the research?	☐ Yes ☐ No ☐ Can't Tell
<i>CONSIDER:</i> • If the researcher has explained how the participants were selected • If they explained why the participants they selected were the most appropriate to provide access to the type of knowledge sought by the study • If there are any discussions around recruitment (e.g. why some people chose not to take part)	
5. Was the data collected in a way that addressed the research issue?	☐ Yes ☐ No ☐ Can't Tell
<i>CONSIDER:</i> • If the setting for the data collection was justified • If it is clear how data were collected (e.g. focus group, semi-structured interview etc.) • If the researcher has justified the methods chosen • If the researcher has made the methods explicit (e.g. for interview method, is there an indication of how interviews are conducted, or did they use a topic guide) • If methods were modified during the study. If so, has the researcher explained how and why • If the form of data is clear (e.g. tape recordings, video material, notes etc.) • If the researcher has discussed saturation of data	
6. Has the relationship between researcher and participants been adequately considered?	☐ Yes ☐ No ☐ Can't Tell
<i>CONSIDER:</i> • If the researcher critically examined their own role, potential bias and influence during (a) formulation of the research questions (b) data collection, including sample recruitment and choice of location • How the researcher responded to events during the study and whether they considered the implications of any changes in the research design	
Section B: What are the results?	
7. Have ethical issues been taken into consideration?	☐ Yes ☐ No ☐ Can't Tell
<i>CONSIDER:</i> • If there are sufficient details of how the research was explained to participants for the reader to assess whether ethical standards were maintained	

<i>If the researcher has discussed issues raised by the study (e.g. issues around informed consent or confidentiality or how they have handled the effects of the study on the participants during and after the study)</i> <i>If approval has been sought from the ethics committee</i>	
8. Was the data analysis sufficiently rigorous?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: <i>If there is an in-depth description of the analysis process</i> <i>If thematic analysis is used. If so, is it clear how the categories/themes were derived from the data</i> <i>Whether the researcher explains how the data presented were selected from the original sample to demonstrate the analysis process</i> <i>If sufficient data are presented to support the findings</i> <i>To what extent contradictory data are taken into account</i> <i>Whether the researcher critically examined their own role, potential bias and influence during analysis and selection of data for presentation</i>	
9. Is there a clear statement of findings?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: <i>If the findings are explicit</i> <i>If there is adequate discussion of the evidence both for and against the researcher's arguments</i> <i>If the researcher has discussed the credibility of their findings (e.g. triangulation, respondent validation, more than one analyst)</i> <i>If the findings are discussed in relation to the original research question</i>	
Section C: Will the results help locally?	
10. How valuable is the research?	☐ Yes ☐ No ☐ Can't Tell
CONSIDER: <i>If the researcher discusses the contribution the study makes to existing knowledge or understanding (e.g., do they consider the findings in relation to current practice or policy, or relevant research-based literature</i> <i>If they identify new areas where research is necessary</i> <i>If the researchers have discussed whether or how the findings can be transferred to other populations or considered other ways the research may be used</i>	

APPRAISAL SUMMARY: List key points from your critical appraisal that need to be considered when assessing the validity of the results and their usefulness in decision-making.		
Positive/Methodologically sound	Negative/Relatively poor methodology	Unknowns

CASP recommends using the Harvard style referencing, which is an author/date method. Sources are cited within the body of your assignment by giving the name of the author(s) followed by the date of publication. All other details about the publication are given in the list of references or bibliography at the end.

Example:

Critical Appraisal Skills Programme (2024). CASP (insert name of checklist i.e. systematic reviews with meta-analysis of randomised controlled trials (RCTs) Checklist.) [online] Available at: insert URL. Accessed: insert date accessed.

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MIXED METHODS APPRAISAL TOOL (MMAT) VERSION 2018

User guide

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What is the MMAT?

The MMAT is a critical appraisal tool that is designed for the appraisal stage of systematic mixed studies reviews, i.e., reviews that include qualitative, quantitative and mixed methods studies. It permits to appraise the methodological quality of five categories to studies: qualitative research, randomized controlled trials, non-randomized studies, quantitative descriptive studies, and mixed methods studies.

How was the MMAT developed?

The MMAT was developed in 2006 (Pluye et al., 2009a) and was revised in 2011 (Pace et al., 2012). The present version 2018 was developed on the basis of findings from a literature review of critical appraisal tools, interviews with MMAT users, and an e- Delphi study with international experts (Hong, 2018). The MMAT developers are continuously seeking for improvement and testing of this tool. Users' feedback is always appreciated.

What the MMAT can be used for?

The MMAT can be used to appraise the quality of empirical studies, i.e., primary research based on experiment, observation or simulation (Abbott, 1998; Porta et al., 2014). It cannot be used for non-empirical papers such as review and theoretical papers. Also, the MMAT allows the appraisal of most common types of study methodologies and designs. However, some specific designs such as economic and diagnostic accuracy studies cannot be assessed with the MMAT. Other critical appraisal tools might be relevant for these designs.

What are the requirements?

Because critical appraisal is about judgment making, it is advised to have at least two reviewers independently involved in the appraisal process. Also, using the MMAT requires experience or training in these domains. For instance, MMAT users may be helped by a colleague with specific expertise when needed.

How to use the MMAT?

This document comprises two parts: checklist (Part I) and explanation of the criteria (Part II).

1. Respond to the two screening questions. Responding 'No' or 'Can't tell' to one or both questions might indicate that the paper is not an empirical study, and thus cannot be appraised using the MMAT. MMAT users might decide not to use these questions, especially if the selection criteria of their review are limited to empirical studies.
2. For each included study, choose the appropriate category of studies to appraise. Look at the description of the methods used in the included studies. If needed, use the algorithm at the end of this document.
3. Rate the criteria of the chosen category. For example, if the paper is a qualitative study, only rate the five criteria in the qualitative category. The 'Can't tell' response category means that the paper do not report appropriate information to answer 'Yes' or 'No', or that report unclear information related to the criterion. Rating 'Can't tell' could lead to look for companion papers, or contact authors to ask more information or clarification when needed. In Part II of this document, indicators are added for some criteria. The list is not exhaustive and not all indicators are necessary. You should agree among your team which ones are important to consider for your field and apply them uniformly across all included studies from the same category.

How to score?

It is discouraged to calculate an overall score from the ratings of each criterion. Instead, it is advised to provide a more detailed presentation of the ratings of each criterion to better inform the quality of the included studies. This may lead to perform a sensitivity analysis (i.e., to consider the quality of studies by contrasting their results). Excluding studies with low methodological quality is usually discouraged.

How to cite this document?

Hong QN, Pluye P, Fàbregues S, Bartlett G, Boardman F, Cargo M, Dagenais P, Gagnon M-P, Griffiths F, Nicolau B, O'Cathain A, Rousseau M-C, Vedel I. Mixed Methods Appraisal Tool (MMAT), version 2018. Registration of Copyright (#1148552), Canadian Intellectual Property

Part I: Mixed Methods Appraisal Tool (MMAT), version 2018

Category of study designs	Methodological quality criteria	Responses			
		Yes	No	Can't tell	Comments
Screening questions (for all types)	S1. Are there clear research questions?				
	S2. Do the collected data allow to address the research questions?				
	<i>Further appraisal may not be feasible or appropriate when the answer is 'No' or 'Can't tell' to one or both screening questions.</i>				
1. Qualitative	1.1. Is the qualitative approach appropriate to answer the research question?				
	1.2. Are the qualitative data collection methods adequate to address the research question?				
	1.3. Are the findings adequately derived from the data?				
	1.4. Is the interpretation of results sufficiently substantiated by data?				
	1.5. Is there coherence between qualitative data sources, collection, analysis and interpretation?				
2. Quantitative randomized controlled trials	2.1. Is randomization appropriately performed?				
	2.2. Are the groups comparable at baseline?				
	2.3. Are there complete outcome data?				
	2.4. Are outcome assessors blinded to the intervention provided?				
	2.5. Did the participants adhere to the assigned intervention?				
3. Quantitative non-randomized	3.1. Are the participants representative of the target population?				
	3.2. Are measurements appropriate regarding both the outcome and intervention (or exposure)?				
	3.3. Are there complete outcome data?				
	3.4. Are the confounders accounted for in the design and analysis?				
	3.5. During the study period, is the intervention administered (or exposure occurred) as intended?				
4. Quantitative descriptive	4.1. Is the sampling strategy relevant to address the research question?				
	4.2. Is the sample representative of the target population?				
	4.3. Are the measurements appropriate?				
	4.4. Is the risk of nonresponse bias low?				
	4.5. Is the statistical analysis appropriate to answer the research question?				
5. Mixed methods	5.1. Is there an adequate rationale for using a mixed methods design to address the research question?				
	5.2. Are the different components of the study effectively integrated to answer the research question?				
	5.3. Are the outputs of the integration of qualitative and quantitative components adequately interpreted?				
	5.4. Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?				
	5.5. Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?				

Part II: Explanations

1. Qualitative studies	Methodological quality criteria
“Qualitative research is an approach for exploring and understanding the meaning individuals or groups ascribe to a social or human problem” (Creswell, 2013b, p. 3). Common qualitative research approaches include (this list if not exhaustive): Ethnography The aim of the study is to describe and interpret the shared cultural behaviour of a group of individuals. Phenomenology The study focuses on the subjective experiences and interpretations of a phenomenon encountered by individuals. Narrative research The study analyzes life experiences of an individual or a group. Grounded theory Generation of theory from data in the process of conducting research (data collection occurs first). Case study In-depth exploration and/or explanation of issues intrinsic to a particular case. A case can be anything from a decision-making process, to a person, an organization, or a country. Qualitative description There is no specific methodology, but a qualitative data collection and analysis, e.g., in-depth interviews or focus groups, and hybrid thematic analysis (inductive and deductive). Key references: Creswell (2013a); Sandelowski (2010); Schwandt (2015)	1.1. Is the qualitative approach appropriate to answer the research question? Explanations The qualitative approach used in a study (see non-exhaustive list on the left side of this table) should be appropriate for the research question and problem. For example, the use of a grounded theory approach should address the development of a theory and ethnography should study human cultures and societies. This criterion was considered important to add in the MMAT since there is only one category of criteria for qualitative studies (compared to three for quantitative studies).
	1.2. Are the qualitative data collection methods adequate to address the research question? Explanations This criterion is related to data collection method, including data sources (e.g., archives, documents), used to address the research question. To judge this criterion, consider whether the method of data collection (e.g., in depth interviews and/or group interviews, and/or observations) and the form of the data (e.g., tape recording, video material, diary, photo, and/or field notes) are adequate. Also, clear justifications are needed when data collection methods are modified during the study.
	1.3. Are the findings adequately derived from the data? Explanations This criterion is related to the data analysis used. Several data analysis methods have been developed and their use depends on the research question and qualitative approach. For example, open, axial and selective coding is often associated with grounded theory, and within- and cross-case analysis is often seen in case study.
	1.4. Is the interpretation of results sufficiently substantiated by data? Explanations The interpretation of results should be supported by the data collected. For example, the quotes provided to justify the themes should be adequate.
	1.5. Is there coherence between qualitative data sources, collection, analysis and interpretation? Explanations There should be clear links between data sources, collection, analysis and interpretation.

2. Quantitative randomized controlled trials	Methodological quality criteria
Randomized controlled clinical trial: A clinical study in which individual participants are allocated to intervention or control groups by randomization (intervention assigned by researchers). Key references: Higgins and Green (2008); Higgins et al. (2016); Oxford Centre for Evidence-based Medicine (2016); Porta et al. (2014)	2.1. Is randomization appropriately performed? Explanations In a randomized controlled trial, the allocation of a participant (or a data collection unit, e.g., a school) into the intervention or control group is based solely on chance. Researchers should describe how the randomization schedule was generated. A simple statement such as ‘we randomly allocated’ or ‘using a randomized design’ is insufficient to judge if randomization was appropriately performed. Also, assignment that is predictable such as using odd and even record numbers or dates is not appropriate. At minimum, a simple allocation (or unrestricted allocation) should be performed by following a predetermined plan/sequence. It is usually achieved by referring to a published list of random numbers, or to a list of random assignments generated by a computer. Also, restricted allocation can be performed such as blocked randomization (to ensure particular allocation ratios to the intervention groups), stratified randomization (randomization performed separately within strata), or minimization (to make small groups closely similar with respect to several characteristics). Another important characteristic to judge if randomization was appropriately performed is allocation concealment that protects assignment sequence until allocation. Researchers and participants should be unaware of the assignment sequence up to the point of allocation. Several strategies can be used to ensure allocation concealment such relying on a central randomization by a third party, or the use of sequentially numbered, opaque, sealed envelopes (Higgins et al., 2016).
	2.2. Are the groups comparable at baseline? Explanations Baseline imbalance between groups suggests that there are problems with the randomization. Indicators from baseline imbalance include: “(1) unusually large differences between intervention group sizes; (2) a substantial excess in statistically significant differences in baseline characteristics than would be expected by chance alone; (3) imbalance in key prognostic factors (or baseline measures of outcome variables) that are unlikely to be due to chance; (4) excessive similarity in baseline characteristics that is not compatible with chance; (5) surprising absence of one or more key characteristics that would be expected to be reported” (Higgins et al., 2016, p. 10).
	2.3. Are there complete outcome data? Explanations Almost all the participants contributed to almost all measures. There is no absolute and standard cut-off value for acceptable complete outcome data. Agree among your team what is considered complete outcome data in your field and apply this uniformly across all the included studies. For instance, in the literature, acceptable complete data value ranged from 80% (Thomas et al., 2004; Zaza et al., 2000) to 95% (Higgins et al., 2016). Similarly, different acceptable withdrawal/dropouts rates have been suggested: 5% (de Vet et al., 1997; MacLehose et al., 2000), 20% (Sindhu et al., 1997; Van Tulder et al., 2003) and 30% for a follow-up of more than one year (Viswanathan and Berkman, 2012).
	2.4. Are outcome assessors blinded to the intervention provided? Explanations Outcome assessors should be unaware of who is receiving which interventions. The assessors can be the participants if using participant reported outcome (e.g., pain), the intervention provider (e.g., clinical exam), or other persons not involved in the intervention (Higgins et al., 2016).
	2.5 Did the participants adhere to the assigned intervention? Explanations To judge this criterion, consider the proportion of participants who continued with their assigned intervention throughout follow-up. “Lack of adherence includes imperfect compliance, cessation of intervention, crossovers to the comparator intervention and switches to another active intervention.” (Higgins et al., 2016, p. 25).

3. Quantitative non-randomized studies	Methodological quality criteria
Non-randomized studies are defined as any quantitative studies estimating the effectiveness of an intervention or studying other exposures that do not use randomization to allocate units to comparison groups (Higgins and Green, 2008).	3.1. Are the participants representative of the target population? Explanations Indicators of representativeness include: clear description of the target population and of the sample (inclusion and exclusion criteria), reasons why certain eligible individuals chose not to participate, and any attempts to achieve a sample of participants that represents the target population.
Common designs include (this list is not exhaustive): Non-randomized controlled trials The intervention is assigned by researchers, but there is no randomization, e.g., a pseudo-randomization. A non-random method of allocation is not reliable in producing alone similar groups.	3.2. Are measurements appropriate regarding both the outcome and intervention (or exposure)? Explanations Indicators of appropriate measurements include: the variables are clearly defined and accurately measured; the measurements are justified and appropriate for answering the research question; the measurements reflect what they are supposed to measure; validated and reliability tested measures of the intervention/exposure and outcome of interest are used, or variables are measured using ‘gold standard’.
Cohort study Subsets of a defined population are assessed as exposed, not exposed, or exposed at different degrees to factors of interest. Participants are followed over time to determine if an outcome occurs (prospective longitudinal).	3.3. Are there complete outcome data? Explanations Almost all the participants contributed to almost all measures. There is no absolute and standard cut-off value for acceptable complete outcome data. Agree among your team what is considered complete outcome data in your field (and based on the targeted journal) and apply this uniformly across all the included studies. For example, in the literature, acceptable complete data value ranged from 80% (Thomas et al., 2004; Zaza et al., 2000) to 95% (Higgins et al., 2016). Similarly, different acceptable withdrawal/dropouts rates have been suggested: 5% (de Vet et al., 1997; MacLehose et al., 2000), 20% (Sindhu et al., 1997; Van Tulder et al., 2003) and 30% for follow-up of more than one year (Viswanathan and Berkman, 2012).
Case-control study Cases, e.g., patients, associated with a certain outcome are selected, alongside a corresponding group of controls. Data is collected on whether cases and controls were exposed to the factor under study (retrospective).	3.4. Are the confounders accounted for in the design and analysis? Explanations Confounders are factors that predict both the outcome of interest and the intervention received/exposure at baseline. They can distort the interpretation of findings and need to be considered in the design and analysis of a non-randomized study. Confounding bias is low if there is no confounding expected, or appropriate methods to control for confounders are used (such as stratification, regression, matching, standardization, and inverse probability weighting).
Cross-sectional analytic study At one particular time, the relationship between health-related characteristics (outcome) and other factors (intervention/exposure) is examined. E.g., the frequency of outcomes is compared in different population subgroups according to the presence/absence (or level) of the intervention/exposure.	3.5 During the study period, is the intervention administered (or exposure occurred) as intended? Explanations For intervention studies, consider whether the participants were treated in a way that is consistent with the planned intervention. Since the intervention is assigned by researchers, consider whether there was a presence of contamination (e.g., the control group may be indirectly exposed to the intervention) or whether unplanned co-interventions were present in one group (Sterne et al., 2016).
Key references for non-randomized studies: Higgins and Green (2008); Porta et al. (2014); Sterne et al. (2016); Wells et al. (2000)	For observational studies, consider whether changes occurred in the exposure status among the participants. If yes, check if these changes are likely to influence the outcome of interest, were adjusted for, or whether unplanned co-exposures were present in one group (Morgan et al., 2017).

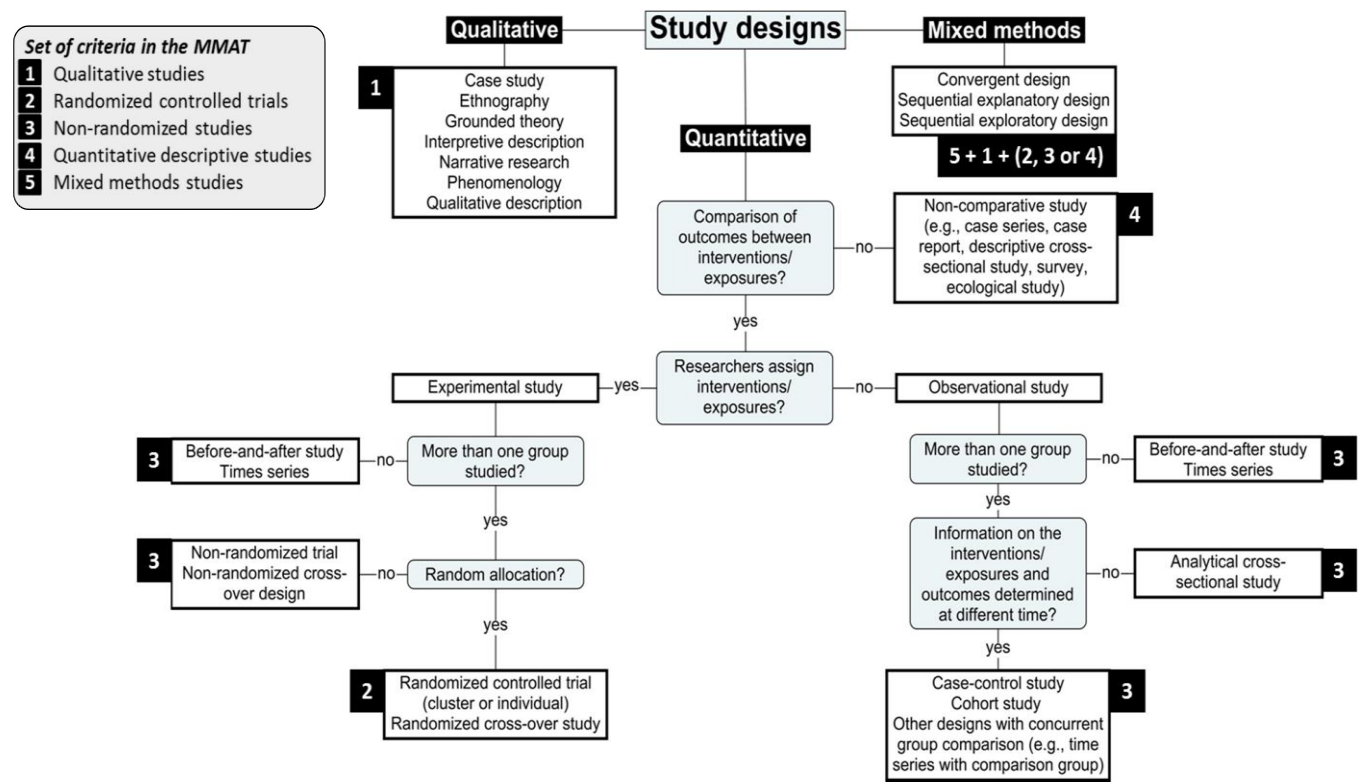
4. Quantitative descriptive studies	Methodological quality criteria
Quantitative descriptive studies are “concerned with and designed only to describe the existing distribution of variables without much regard to causal relationships or other hypotheses” (Porta et al., 2014, p. 72). They are used to monitoring the population, planning, and	4.1. Is the sampling strategy relevant to address the research question? Explanations Sampling strategy refers to the way the sample was selected. There are two main categories of sampling strategies: probability sampling (involve random selection) and non-probability sampling. Depending on the research question, probability sampling might be preferable. Non-probability sampling does not provide equal chance of being selected. To judge this criterion, consider whether the source of sample is relevant to the target population; a clear justification of the sample frame used is provided; or the sampling procedure is adequate.

generating hypothesis (Grimes and Schulz, 2002). Common designs include the following single-group studies (this list if not exhaustive): Incidence or prevalence study without comparison group In a defined population at one particular time, what is happening in a population, e.g., frequencies of factors (importance of problems), is described (portrayed). Survey “Research method by which information is gathered by asking people questions on a specific topic and the data collection procedure is standardized and well defined.” (Bennett et al., 2011, p. 3). Case series A collection of individuals with similar characteristics are used to describe an outcome. Case report An individual or a group with a unique/unusual outcome is described in detail. Key references: Critical Appraisal Skills Programme (2017); Draugalis et al. (2008)	4.2. Is the sample representative of the target population? Explanations There should be a match between respondents and the target population. Indicators of representativeness include: clear description of the target population and of the sample (such as respective sizes and inclusion and exclusion criteria), reasons why certain eligible individuals chose not to participate, and any attempts to achieve a sample of participants that represents the target population. 4.3. Are the measurements appropriate? Explanations Indicators of appropriate measurements include: the variables are clearly defined and accurately measured, the measurements are justified and appropriate for answering the research question; the measurements reflect what they are supposed to measure; validated and reliability tested measures of the outcome of interest are used, variables are measured using ‘gold standard’, or questionnaires are pre-tested prior to data collection. 4.4. Is the risk of nonresponse bias low? Explanations Nonresponse bias consists of “an error of nonobservation reflecting an unsuccessful attempt to obtain the desired information from an eligible unit.” (Federal Committee on Statistical Methodology, 2001, p. 6). To judge this criterion, consider whether the respondents and non- respondents are different on the variable of interest. This information might not always be reported in a paper. Some indicators of low nonresponse bias can be considered such as a low nonresponse rate, reasons for nonresponse (e.g., noncontacts vs. refusals), and statistical compensation for nonresponse (e.g., imputation). The nonresponse bias is might not be pertinent for case series and case report. This criterion could be adapted. For instance, complete data on the cases might be important to consider in these designs. 4.5. Is the statistical analysis appropriate to answer the research question? Explanations The statistical analyses used should be clearly stated and justified in order to judge if they are appropriate for the design and research question, and if any problems with data analysis limited the interpretation of the results.
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5. Mixed methods studies	Methodological quality criteria
Mixed methods (MM) research involves combining qualitative (QUAL) and quantitative (QUAN) methods. In this tool, to be considered MM, studies have to meet the following criteria (Creswell and Plano Clark, 2017): (a) at least one QUAL method and one QUAN method are combined; (b) each method is used rigorously in accordance to the generally accepted criteria in the area (or tradition) of research invoked; and (c) the combination of the methods is carried out at the minimum through a MM design (defined <i>a priori</i>, or emerging) and the integration of the QUAL and QUAN phases, results, and data. Common designs include (this list if not exhaustive): Convergent design The QUAL and QUAN components are usually (but not necessarily) concomitant. The purpose is to examine the same phenomenon by interpreting QUAL and QUAN results (bringing data analysis together at the interpretation stage), or by integrating QUAL and QUAN datasets (e.g., data on same cases), or by transforming data (e.g., quantization of	5.1. Is there an adequate rationale for using a mixed methods design to address the research question? Explanations The reasons for conducting a mixed methods study should be clearly explained. Several reasons can be invoked such as to enhance or build upon qualitative findings with quantitative results and vice versa; to provide a comprehensive and complete understanding of a phenomenon or to develop and test instruments (Bryman, 2006).
	5.2. Are the different components of the study effectively integrated to answer the research question? Explanations Integration is a core component of mixed methods research and is defined as the “explicit interrelating of the quantitative and qualitative component in a mixed methods study” (Plano Clark and Ivankova, 2015, p. 40). Look for information on how qualitative and quantitative phases, results, and data were integrated (Pluye et al., 2018). For instance, how data gathered by both research methods was brought together to form a complete picture (e.g., joint displays) and when integration occurred (e.g., during the data collection-analysis or/and during the interpretation of qualitative and quantitative results).
	5.3. Are the outputs of the integration of qualitative and quantitative components adequately interpreted? Explanations This criterion is related to meta-inference, which is defined as the overall interpretations derived from integrating qualitative and quantitative findings (Teddlie and Tashakkori, 2009). Meta-inference occurs during the interpretation of the findings from the integration of the qualitative and

qualitative data). Sequential explanatory design Results of the phase 1 - QUAN component inform the phase 2 - QUAL component. The purpose is to explain QUAN results using QUAL findings. E.g., the QUAN results guide the selection of QUAL data sources and data collection, and the QUAL findings contribute to the interpretation of QUAN results. Sequential exploratory design Results of the phase 1 - QUAL component inform the phase 2 - QUAN component. The purpose is to explore, develop and test an instrument (or taxonomy), or a conceptual framework (or theoretical model). E.g., the QUAL findings inform the QUAN data collection, and the QUAN results allow a statistical generalization of the QUAL findings. Key references: Creswell et al. (2011); Creswell and Plano Clark, (2017); O'Cathain (2010)	quantitative components, and shows the added value of conducting a mixed methods study rather than having two separate studies. 5.4. Are divergences and inconsistencies between quantitative and qualitative results adequately addressed? Explanations When integrating the findings from the qualitative and quantitative components, divergences and inconsistencies (also called conflicts, contradictions, discordances, discrepancies, and dissonances) can be found. It is not sufficient to only report the divergences; they need to be explained. Different strategies to address the divergences have been suggested such as reconciliation, initiation, bracketing and exclusion (Pluye et al., 2009b). Rate this criterion ‘Yes’ if there is no divergence. 5.5. Do the different components of the study adhere to the quality criteria of each tradition of the methods involved? Explanations The quality of the qualitative and quantitative components should be individually appraised to ensure that no important threats to trustworthiness are present. To appraise 5.5, use criteria for the qualitative component (1.1 to 1.5), and the appropriate criteria for the quantitative component (2.1 to 2.5, or 3.1 to 3.5, or 4.1 to 4.5). The quality of both components should be high for the mixed methods study to be considered of good quality. The premise is that the overall quality of a mixed methods study cannot exceed the quality of its weakest component. For example, if the quantitative component is rated high quality and the qualitative component is rated low quality, the overall rating for this criterion will be of low quality.
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Algorithm for selecting the study categories to rate in the MMAT*



*Adapted from National Institute for Health Care Excellence. (2012). *Methods for the development of nice public health guidance*. London: National Institute for Health and Care Excellence; and Scottish Intercollegiate

Appendix H: Survey form

Survey Questionnaire: Optimizing Agile Project Management in the Global Telecommunications Industry

This survey is part of a research study on scaling agile frameworks in global telecom projects. It aims to gather insights from telecom professionals across Eurasia on their experiences with agile (or hybrid agile) methodologies in 5G and cloud infrastructure projects. Your feedback will help identify best practices and areas for improvement in agile project management for the telecommunications industry. *All responses will be kept confidential.* Recent industry research shows that, agile transformations can greatly improve performance (telcos adopting agile are 3× more likely to become top-quartile performers), underscoring the importance of optimizing agile practices in this domain.

In the light of the above statement do you agree to give your consent in participating in this research and providing your valuable input? If you choose yes then your consent will be recorded.

- Yes
- No

Section A: Demographics

1. Which geographical area (in Eurasia) are you currently serving in? _____ -
2. Which best describes your organizations type (domain) in the telecom industry?
- Telecom Operator/Service Provider (CSP)
- Telecom Vendor/Supplier (network equipment, software, etc.)
- Consulting/Services Firm in Telecom Domain
- Government/Regulatory or Industry Association
- Other (please specify)
3. What is your identified role in your team or project, in telecom industry’s selected domain?
- Developer
- Scrum Master
- Product Owner
- QA/Test Engineer
- Project/Program Manager
- Agile Coach
- Other
4. What is the duration of service in your specified role in telecom industry in Agile methodology
- Less than 1 year
- 1–3 years
- 4–7 years
- 8+ years
5. Please state the name of the telecom company for which you are currently serving?
- _____

Section B: Quantitative data

1. Primary Agile Framework/Approach: Which agile or scaled-agile framework does your team primarily follow for project delivery? (Select one)

- ☐SAFe (Scaled Agile Framework)
- ☐LeSS (Large-Scale Scrum)
- ☐Spotify model
- ☐Disciplined Agile (DA)
- ☐Scrum/Scrum of Scrums (scaled without a formal framework)
- ☐Hybrid or Customized (mix of agile with traditional methods)
- ☐Other (please specify)

2. Team Size: Approximately how many members are in your agile team (or immediate project group)?

- ☐1–5 members
- ☐6–10 members
- ☐11–20 members
- ☐21–50 members
- ☐51+ members

3. Team Distribution: Is your current project team distributed across multiple countries/locations?

- ☐No – Mostly co-located in one country
- ☐Yes – Team members across multiple countries/time zones
- ☐Other – Please describe (e.g. “multiple sites within one country,” etc.)

Section C: Likert scale questions: Agile Practices and Outcomes

This section covers your agile adoption, challenges, and outcomes. Please answer the following multiple-choice and Likert-scale questions based on your experience

Q1

Satisfaction with Framework: How satisfied are you with the effectiveness of the current agile framework/approach your team is using?	1 – Very Dissatisfied	2 – Somewhat Dissatisfied	3 – Somewhat Satisfied	4 – Very Satisfied
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Q2 Implementation Challenges – To what extent are each of the following factors challenging in scaling agile across your telecom projects? (Rate each from 1 = *Not a challenge* to 4 = *Major challenge*)

Statement	1 – major challenge	1 – minor challenge	2 - neutral	4 – not a challenge
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Cross-site coordination – Managing work across dispersed or offshore teams (time zone differences, limited face- to-face communication)				
Training & skill gaps – Ensuring teams have sufficient agile training, coaching, and skill levels				
Regulatory compliance – Meeting local regulatory or compliance requirements (security, auditing, etc.) within an agile workflow				
Governance alignment – Integrating agile practices with existing governance or PMO processes and controls				
Organizational culture – Company culture or hierarchy resisting agile change (e.g. siloed departments, aversion to risk)				
Leadership support – Lack of executive sponsorship or understanding of agile, causing roadblocks to adoption				

Q3: Outcomes of Agile Adoption – How has adopting agile (at scale) impacted the following in your projects? (Rate each from 1 = *No improvement or negative impact* to 4 = *Significant improvement*):

Statement	1 – No improvement	2 – Significant improvement	3 – Major improvement	4 – Minor improvement
Delivery speed (Time-to-market) – ability to deliver products or features faster				
Customer satisfaction – improved client/customer experience or NPS scores				
Product/Service quality – quality of deliverables or network/service performance				

Q4: Governance and PMO Integration – Indicate your level of **agreement** with each statement about how agile fits into your organization’s management structure. (1 = *Strongly Disagree*, 4 = *Strongly Agree*):

Statement	1. Strongly agree	2. Agree	3. Neutral	4. strongly disagree
“Our agile teams work in harmony with our organization’s governance processes and Project Management Office (PMO) guidelines.”				
“The PMO (or equivalent governance body) provides effective support and oversight for projects running with agile methods.”				

Q5: Adaptation to Cross-Border Context – Indicate your **agreement** with the following statements about adapting agile in a multi-country environment. (1 = *Strongly Disagree*, 4 = *Strongly Agree*):

Statement	1. Strongly agree	2. Agree	3. Neutral	4. strongly disagree
“We have tailored our agile methodology to address different regulatory or compliance requirements in the countries where we operate.”				
“Our team has effective practices to handle cross-border challenges (e.g. time zone gaps, language/cultural differences) when working agile.”				

Appendix I: Coding sheet for thematic analysis

(1) Theme 1: Application and Emerging Hybrid Practices of Scaled Agile Frameworks in Multinational Telecom Projects

Theme 1 (RQ1) Application and Emerging Hybrid Practices of Scaled Agile Frameworks in Multinational Telecom Projects		
Study title and year	Code	Insight
An agile and effective network function virtualization infrastructure for the Internet of Things <i>(Mattos et al., 2019)</i>	Virtualized access gateway for multiple IoT domains	The study proposes a simple gateway access node that, creates virtual access points to serve <i>different IoT domains</i> from a single physical gateway, a way of “scaling” service delivery across domains without changing edge devices.
	Service Function Chaining (SFC) as the agility mechanism	Packets are classified and sent through service function chains in the NFVI; the chain defines “which functions, in which order,” so services can be recomposed quickly for each domain, that,’s the core “agile” part of the infrastructure.
	Outsourcing network functions from constrained edge	Because IoT/telco edge devices have processing and power constraints , the paper “outsources” security, QoS, and protocol adaptation to the virtualized cloud infra, keeping the access node light. This is an <i>application pattern</i> for resource-poor sites.
	Per-domain tailored services	“Each IoT domain might deploy different network services implemented by VNFs”, i.e. per-slice customisation (security-heavy vs QoS-heavy), which in your dissertation language maps to “emerging hybrid practices per context.”
	Separation of access and processing (telco-style C-RAN idea)	They align the gateway idea with 5G / C-RAN architectures , access is simplified and forwarding-only; intelligence is central. This is a telco-style pattern: centralise control, keep RAN light.
	Use of mature telco tooling (OPNFV, OpenStack, Open vSwitch)	Implementation is deliberately on OPNFV (ETSI NFV MANO) + OpenStack + Open vSwitch, i.e. they “hybridise” agile/virtualised ideas on top of existing telco-grade stacks, not bespoke research code. That,’s a real-world application signal.
Cloud Computing and Its Impact on Telecommunication Infrastructure <i>(Axel Egon, 2024)</i>	SDN/NFV	Cloud lets telcos decouple control from data plane (SDN) and virtualise network functions on commodity/cloud infra (NFV) to deploy services faster and more flexibly than legacy, hardware-based networks.
	Edge rollout	Telcos push compute/storage to the edge to reduce latency and support real-time/IoT, which is described as a direct outcome of cloud–telecom convergence.
	Cloud services	Providers now offer cloud-hosted comms/collab, IoT platforms, analytics on top of their networks, a new cloud-native service layer on telco infra.
	Virtual overlays	SDN allows creation of virtual network overlays that, are dynamically configured for cloud-based apps, so the network matches service requirements.
	CDN integration	Telcos integrate CDNs with cloud to deliver content/applications from nearest nodes , improving delivery while offloading the core.

	OPEX model	Adoption is packaged with a pay-as-you-go / service-centric model, so telcos can run cloud-based network functions without big CAPEX outlay.
<i>From Adoption to Sustainability: A Journey of Large-Scale Agile Implementation</i> <i>(Abubakkar & Dorasamy, 2023)</i>	Exec Support	Executive-level sponsorship, including the CEO, visibly championed the transformation, accelerating acceptance across HQ and state units.
	Iterative Rollout	Agile was introduced in small patches and scaled iteratively from pilot areas (B2C/SME) to wider regions, mirroring phased telecom deployments.
	Change Commitment	Organizational readiness and willingness to embrace change were monitored continuously; teams internalized ceremonies and rituals.
	Hybrid Practice	The company blended top-down governance with bottom-up agile squads, creating a hybrid model adapted to telco hierarchy.
	Coach Network	Agile Coaches / Heads of Coaches acted as change agents bridging management and delivery, sustaining practices company-wide.
<i>TRANSFORMING TELECOM WORKLOADS TO CLOUD-NATIVE INFRASTRUCTURE USING MICROSERVICES AND KUBERNETES</i> <i>(Srikanth, 2025)</i>	Cloud-Native Network Functions (NFV/SDN)	Telecom projects decompose network functions into modular virtual components, enabling rapid iterations and continuous service evolution similar to agile sprints.
	Edge-Driven Sprint Cycles	Distributed edge nodes are managed as independent agile teams delivering localized functionality within coordinated global release trains.
	Digital Collaboration Platforms	Cross-border telecom teams rely on cloud-based platforms (e.g., Jira, Confluence, Teams) to synchronize backlog management, sprint reviews, and retrospectives.
	Hybrid Cloud Delivery Models	Companies combine public and private clouds for balancing flexibility with regulatory control, mirroring hybrid agile approaches that, mix iterative and stage-gate processes.
	Continuous Integration & Deployment Pipelines	Automated pipelines (CI/CD) ensure frequent, incremental updates to telecom services, reflecting scaled agile delivery cadences.
	Integrated Network–IT Teams	Telecom engineers, software developers, and DevOps specialists operate as unified squads, aligning network evolution with agile product development cycles.
	Microservices Decomposition for Agile Delivery	Transitioning monolithic telecom workloads into microservices enables smaller, independently deployable components aligned with agile iteration.
	Kubernetes-Orchestrated Workflow Management	Kubernetes orchestration provides automated scaling and resilience, supporting continuous deployment across globally distributed agile teams.
	Service Mesh-Enabled Collaboration	Service mesh layers (e.g., Istio) enhance inter-team coordination by providing standardized communication policies across microservices.
	Containerized Development Environments	Dockerized environments standardize toolchains across global teams, removing friction in testing and deployment cycles.
	Cloud-Native Network Functions (NFV/SDN)	Telecom projects decompose network functions into modular virtual components, enabling rapid iterations and continuous service evolution similar to agile sprints.

Analysis of Hybrid Agile Project Management in the Telecommunications Industry <i>(Aydin et al., 2025)</i>	Hybrid Agile Integration	Telecom firms combine Waterfall and Agile (Scrum, Kanban, DevOps) to handle security, regulation, and innovation simultaneously, enabling both predictability and adaptability.
	Customized Scrum Model	The company developed its own Scrum variant with added roles, Analyst Phase Leader (APL) and Development Phase Leader (DPL), to bridge Agile teams and the PMO.
	Scaled Agile Framework (SAFe) Adoption	SAFe was cautiously introduced to align multiple Agile teams across departments while managing compliance and resource constraints.
	Hybrid Lifecycle Approach	Projects follow PMBOK stages (Initiation to Closure) integrated with Agile sprints and iterative planning cycles, blending control with agility.
	Multi-Method Coexistence	Teams apply Scrum for innovation, Kanban for operational tasks, and Lean for efficiency, each chosen based on project type.
	Enterprise-Level Coordination	PMOs evaluate projects based on KPIs and stakeholder involvement, linking business goals with Agile execution.
	Framework Convergence (TOGAF + Agile)	TOGAF principles are aligned with Agile iterations to unify architecture governance with adaptive project delivery.
The use of Agile project management methodology for software development in the telecommunications industry <i>(Zhanbolat, 2022)</i>	Scaled Agile Framework (SAFe) Integration	SAFe is commonly used to coordinate large, cross-functional teams across international telecom units, providing synchronization while maintaining Agile autonomy.
	Hybrid Project Management Models	Telecom firms combine Agile (Scrum/Kanban) with traditional governance (PMI or PRINCE2) to balance adaptability and compliance.
	Incremental Delivery Strategy	Agile practices enable incremental rollout of telecom products, improving responsiveness to market and customer needs.
	Agile Release Trains (ARTs)	ARTs serve as the central coordination mechanism for distributed teams, aligning product increments and delivery cycles.
	Continuous Delivery and DevOps	Integration of DevOps and Agile accelerates testing, deployment, and feedback, ensuring end-to-end visibility.
	Portfolio-Level Agile Governance	Strategic alignment is maintained through Agile portfolio boards ensuring that, local teams operate within enterprise priorities.
Critical Success Factors for the Application of Agile Methodology in, IT Telecommunication Projects: A Mixed Method Research Approach <i>(Adel & Fattah, 2020)</i>	Adoption of Hybrid Agile Models	Telecom projects often combine Agile and traditional project management (PMBOK/Waterfall) to manage complex dependencies and compliance requirements, ensuring both flexibility and control.
	Use of Scrum with Telecom-Specific Adaptations	Scrum is the dominant Agile framework, but its ceremonies and roles are modified to fit telecom structures, with roles like Product Owner adapted to align with service delivery functions.
	Cross-Departmental Agile Implementation	Agile is applied across departments (network, IT, and operations), enabling collaboration between technical and managerial teams through shared sprint goals and review sessions.
	Integration of Kanban for Operational Stability	Kanban boards are used alongside Scrum to manage continuous operations and maintenance work, providing visibility and improving throughput in service delivery.

	Scaling through Coordinated Agile Teams	Multiple Agile teams are synchronized across geographies using shared sprint cycles and communication tools, enabling scalability and alignment in large telecom programs.
	Incremental and Iterative Delivery Approach	Telecom organizations implement iterative delivery through short sprints and frequent product increments, which reduce risk and allow earlier customer feedback in multi-market rollouts.
Internet Technologies & Society and Sustainability. Technology and Education (Grundler & Westerner, 2019)	Multiple Framework Ecosystem (Scrum of Scrums, LeSS, DA, SAFe)	Organizations apply various scaling frameworks such as Scrum of Scrums, Large Scale Scrum (LeSS), Disciplined Agile (DA), and SAFe to coordinate multiple teams across complex project portfolios.
	Portfolio-Level Agility Integration	Scaling Agile frameworks extend Agile principles to the portfolio level, integrating strategy and execution through coordination mechanisms like Agile Portfolio Management and Kanban systems.
	Product over Project Orientation	Frameworks like SAFe and LeSS shift from traditional project-based management to a product- or value-stream-centric model, changing governance structures and roles.
	Decentralized Decision-Making and Lean Governance	Decision-making authority shifts downward through Lean Portfolio Management and self-managing teams, replacing top-down control with empowered execution.
	Synchronization through Cadence Mechanisms	Scaled Agile frameworks maintain alignment via structured cadences—Program Increment Planning (SAFe), Sprint Planning (LeSS), and Meta-Scrum (Scrum of Scrums)—ensuring continuous synchronization across global teams.
	Integration with Traditional PPM	Frameworks such as SAFe explicitly align with Project Portfolio Management (PPM) objectives, incorporating structured governance, metrics, and funding models within Agile practices.

(2) Theme 2: Cross-Border Challenges and Mitigation Strategies in Scaling Agile

Theme 2 (RQ2) Cross-Border Challenges and Mitigation Strategies in Scaling Agile		
Study title and year	Code	Insight
An agile and effective network function virtualization infrastructure for the Internet of Things (Mattos et al., 2019)	Fragmented Regulatory Ecosystems	Varying national telecom regulations (e.g., GDPR, TRAI) create inconsistency, complicating global agile adoption.
	Latency of Decision-Making	Distributed governance structures slow decision-making, contradicting agile’s responsiveness.
	Cultural Misalignment	Teams across regions exhibit differing risk tolerance and feedback norms, weakening sprint collaboration.
	Legacy Infrastructure Constraints	Old telecom systems resist modularization, making scaling agile more complex and resource-intensive.
	Skill Scarcity and Agile Literacy Gaps	Shortages of agile-trained engineers, particularly in network operations, impede transformation momentum.
	Mitigation through Federated Operating Models	Firms adopt “federated agility,” empowering regional teams under global coordination frameworks to balance autonomy with consistency.
From Adoption to Sustainability: A Journey of Large-Scale Agile Implementation (Abubakkar & Dorasamy, 2023)	Hierarchy Barrier	Bureaucratic, siloed structures and state-level hierarchies slowed agile adoption and knowledge flow.
	Complexity	Large organizational scale and dependencies made implementation sluggish and outcomes slower to surface.
	Cross-Functional Integration	Integrating finance, procurement, and non-core teams required dedicated collaboration sessions to bridge delivery gaps.
	Resistance to Change	Senior and mid-level managers showed mindset inertia; cascading understanding downward remained difficult.
	Resource Strain	Limited number of skilled coaches and trainers hindered consistent scaling across units; sustained investment was needed
Analysis of Hybrid Agile Project Management in the Telecommunications Industry (Aydin et al., 2025)	Cultural Resistance and Hierarchical Barriers	Hierarchical corporate culture slows down Agile adoption, especially in middle management, impeding collaboration.
	Resource Overload and Role Confusion	PMs handle 7–8 projects concurrently while Agile teams split time across projects, reducing focus and causing coordination conflicts.
	Regulatory and Security Constraints	Strict telecom regulations (e.g., data privacy, financial integrity) limit full Agile transformation, requiring hybrid methods for compliance.
	Fragmented Communication	Multi-directorate collaboration (legal, finance, IT) creates communication gaps and delays, leading to inter-team friction.
	Inconsistent Agile Maturity	While some divisions achieve 70% Agile maturity, others resist change, resulting in uneven adoption.
	Lack of Standardization	Absence of a unified hybrid framework (PMBOK + Agile) complicates implementation and limits scalability.

	Conflict between PMs and Agile Teams	Limited authority of APLs/DPLs and unclear governance boundaries cause recurring conflict between PMs and Agile roles.
<i>The use of Agile project management methodology for software development in the telecommunications industry</i> <i>(Zhanbolat, 2022)</i>	Cultural Misalignment Across Regions	Differences in risk tolerance, hierarchy, and communication norms hinder uniform Agile adoption across global teams.
	Distributed Team Coordination	Time zone and communication gaps reduce sprint synchronization and cause delivery delays.
	Governance Rigidity	Legacy corporate structures restrict flexibility, often slowing down decision-making and backlog prioritization.
	Role Confusion and Accountability Gaps	New Agile roles (RTEs, Product Owners) overlap with existing managerial hierarchies, causing unclear responsibilities.
	Tool Fragmentation	Different regions use varying project management tools, impeding transparency and progress tracking.
<i>Secure Global Software Development: A Practitioners’ Perspective</i> <i>(Humayun et al., 2023)</i>	Organizational Size Influences Practice Adoption	Larger GSD organizations emphasize formalized security practices more consistently, while smaller ones lack structured frameworks, indicating size-dependent maturity.
	Scale Determines Security Priorities	Larger firms rated “requirement dependencies” (RE3) as highly critical (61%) versus only 25% in small firms, showing stronger focus on dependency management in large setups.
	Formal Change Management in Large Organizations	Large firms consistently follow and document change management processes (DP1–DP2), unlike small firms, due to higher regulatory and compliance demands.
	Varying Risk Assessment Depth	Small firms tend to skip comprehensive risk identification (RE6) compared to medium and large ones, linking firm resources to the extent of security planning.
	Distributed Security Ownership in Large Teams	Larger GSD teams employ multi-level security mechanisms (D7) because of geographically dispersed collaboration, whereas small firms depend on ad-hoc measures.
	Tool Usage and Automation Correlation	Automated secure coding checklists and validation (C1, C5) were more frequently implemented in larger organizations, suggesting tool-based governance grows with company size.
	Chi-Square Correlation Evidence	Statistical tests ($\chi^2 = 0.07211$, $p < 0.05$) confirm a significant relationship between organization size and selected security practices, larger size correlates with higher implementation frequency.

(3) Theme 3: Impacts of Scaling Agile on Delivery Speed, Quality, and Stakeholder Satisfaction

Theme 3 (RQ3) Impacts of Scaling Agile on Delivery Speed, Quality, and Stakeholder Satisfaction		
Study title and year	Code	Insight
An agile and effective network function virtualization infrastructure for the Internet of Things (Mattos et al., 2019)	Cycle Time Compression	Telecom case studies show agile deployment reduces time-to-market for 5G service launches by up to 30%.
	Customer Co-Creation	Agile ceremonies extended to customers (e.g., beta testing) improve satisfaction and perception of responsiveness.
	Quality through Automated Testing	Continuous testing pipelines enhance software reliability and reduce post-release incidents.
	Transparent Metrics Dashboards	KPI-driven visibility (velocity, defect rate) strengthens stakeholder trust and alignment.
	Network Reliability Improvements	Incremental upgrades using agile principles reduce downtime and enable proactive fault detection.
	Employee Empowerment as Satisfaction Driver	Increased autonomy and team accountability correlate with higher employee engagement and innovation rates.
	Faster Time-to-Market	Cloud-enabled automation and virtualization (as in Vodafone’s rollout) significantly reduce deployment cycles, improving delivery speed.
Cloud Computing and Its Impact on Telecommunication Infrastructure (Axel Egon, 2024)	Service Elasticity	Agile-like scalability through on-demand cloud resources enhances adaptability to customer demands, increasing stakeholder satisfaction.
	Quality of Service (QoS) Optimization	Technologies such as SDN and CDNs enable real-time optimization of service quality, mirroring agile’s inspect-and-adapt cycles.
	Operational Efficiency (OPEX Model)	Transitioning from CAPEX to OPEX models supports iterative funding and experimentation, fostering agility and faster delivery of value.
	Improved Customer Experience	Unified cloud communications improve end-user satisfaction through consistent, responsive service delivery.
	Predictive Maintenance via AI/ML	Cloud-based AI systems enhance reliability and quality through predictive maintenance, aligned with agile’s focus on continuous improvement.
TRANSFORMING TELECOM WORKLOADS TO CLOUD-NATIVE INFRASTRUCTURE USING MICROSERVICES AND KUBERNETES (Srikanth, 2025)	Cycle Time Compression	Moving from manual releases to automated CI/CD pipelines reduced deployment cycles from months to days, accelerating time-to-market for telecom services.
	Enhanced Network Reliability and Fault Recovery	Agile principles embedded in DevOps pipelines enable rapid rollback and self-healing features, minimizing downtime.
	Improved SLA Compliance via Self-Healing Mechanisms	Cloud-native orchestration automatically restores failed network components, improving SLA adherence and service stability.

	Transparent Performance Metrics	Scaled agile introduces observability dashboards that, display latency, error rates, and uptime, enhancing transparency for all stakeholders.
	Operational Efficiency and Resource Optimization	Agile-driven resource orchestration reduces idle capacity and operational costs through elastic cloud scaling.
	End-to-End Service Observability and Telemetry	Continuous monitoring aligns with agile feedback loops, providing real-time visibility into network health and service delivery.
	Employee Empowerment through Automation	Automation relieves engineers from repetitive tasks, promoting ownership, innovation, and engagement consistent with agile culture.
	Customer Co-Creation and Feedback Loops	Customers participate in pilot rollouts and provide early feedback, directly influencing product backlog priorities.
	Predictive Maintenance and Fault Detection	ML-driven analytics proactively detect faults, improving quality assurance and stakeholder confidence in agile delivery.
	Resilience through Multi-Cluster Deployment Strategies	Deploying services across multiple clusters ensures business continuity, enhancing perceived quality and satisfaction.
Critical Success Factors for the Application of Agile Methodology in, IT Telecommunication Projects: A Mixed Method Research Approach (Adel & Fattah, 2020)	Improved Time-to-Market (TTM)	The study reports that, agile adoption in telecom projects significantly reduced delivery time, leading to faster time-to-market for digital and managed service solutions.
	Enhanced Team Communication	Daily stand-ups, virtual meetings, and transparent communication channels led to better coordination and faster issue resolution, which directly improved delivery speed and quality.
	Optimal Team Size (5–9 Members)	Teams of five to nine were found most effective in maintaining agility and communication, positively influencing project speed and stakeholder satisfaction.
	Management Involvement as Governance (Not Micromanagement)	Projects succeeded when management acted as governance facilitators rather than micromanagers, improving morale and satisfaction across stakeholders.
	Customer Involvement and Daily Interaction	Continuous customer collaboration ensured better alignment between requirements and outcomes, enhancing perceived quality and stakeholder satisfaction.
	Correlation between People & Organisational Factors and Project Value	Statistical analysis showed a positive correlation between team performance, communication, and project success (delivery value), demonstrating tangible impacts of agile scaling.
	Hybrid Agile Practices (Kanban + Traditional Governance)	Hybrid frameworks (e.g., Kanban combined with traditional oversight) balanced flexibility and structure, improving quality control without delaying delivery.

	Stakeholder Confidence and Transparency	Agile visibility through Kanban boards and iterative feedback loops improved stakeholder trust, engagement, and satisfaction with project outcomes.
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(4) Theme 4: Tailoring Agile Frameworks for Global Telecom Projects to Enhance Outcomes

Theme 4 (RQ4) Tailoring Agile Frameworks for Global Telecom Projects to Enhance Outcomes		
Study title and year	Code	Insight
An agile and effective network function virtualization infrastructure for the Internet of Things (Mattos et al., 2019)	Geo-Adaptive Sprint Structuring	Sprint cycles are aligned to regional workweeks and regulatory calendars for smoother coordination.
	Localized Governance Pods	Local scrum-of-scrums ensure contextual decision-making while maintaining global synchronization.
	Regulatory Compliance Integration	Compliance is embedded into definition-of-done checklists to maintain agility under legal constraints.
	Digital Twin Simulation Environments	Telecom firms simulate deployments using cloud-based digital twins before live rollout, an agile adaptation for complex infrastructure.
	Scaled Agile Coaching Networks	Regional agile coaches form “communities of practice” to ensure methodological consistency across continents.
	Outcome-Based OKRs	Global telecom programs link agile increments to customer or performance outcomes rather than output metrics.
Cloud Computing and Its Impact on Telecommunication Infrastructure (Axel Egon, 2024)	Localized Edge Deployment	Positioning compute nodes near customers enables regional customization, akin to tailoring agile backlogs for local contexts.
	Collaborative Ecosystems (Cloud Partnerships)	Joint ventures between telecoms and cloud providers exemplify ecosystem-based agility for global scalability.
	Regulatory-Aware Agile Governance	Incorporating compliance gates within iterative cycles ensures agility without breaching telecom regulations.
	AI-Driven Adaptation Loops	AI-enabled analytics in telecom clouds inform adaptive decision-making, reinforcing agile feedback loops.
	Sustainability-Focused Practices	Integrating green infrastructure aligns agile retrospectives with environmental performance metrics.
	Phased Migration Strategy	Case evidence (AT&T, Telecom Italia) underscores incremental, sprint-like migrations as effective tailoring of agile for telecom modernization.
From Adoption to Sustainability: A Journey of Large-Scale Agile Implementation	Agile Leadership	Empowered leaders at GM level cascaded agile behaviour through divisions, acting as internal change multipliers.
	Continuous Training	Agile Accelerator programs and business-acumen training were institutionalised to maintain alignment with telecom goals.
	Cultural Alignment	KPIs and customer-centric objectives were reframed to reflect agile values, embedding culture change.

(Abubakkar & Dorasamy, 2023)	Non-Core Integration	Extending agile beyond core delivery (HR, Finance, Procurement) remained challenging yet essential for holistic tailoring.
	Sustainable Model	The transformation aimed to evolve into a permanent, sustainable operating model rather than a one-off program.
TRANSFORMING TELECOM WORKLOADS TO CLOUD-NATIVE INFRASTRUCTURE USING MICROSERVICES AND KUBERNETES (Srikanth, 2025)	Geo-Adaptive Sprint Structuring	Sprint calendars are synchronized with regional working patterns and time zones, improving coordination in global agile teams.
	Localized Governance Pods	Regional “scrum-of-scrums” manage dependencies locally while aligning with global program objectives, preserving agility across jurisdictions.
	Regulatory Compliance Integration	Compliance milestones (e.g., data localization, licensing) are embedded into the agile definition of done to balance speed with governance.
	Phased Migration and Refactoring Strategy	Legacy systems are incrementally modernized through sprint-based refactoring to minimize operational disruption.
	Domain-Driven Design (DDD) for Modular Architecture	Telecom workloads are structured around business domains, allowing each agile team to manage its microservice independently.
	Digital Twin Simulation for Pre-Deployment Testing	Cloud-based simulation environments validate system behavior before release, reducing risk in large-scale telecom deployments.
	Scaled Agile Coaching Networks	Global telecom firms build internal communities of agile coaches to sustain practices and contextualize training for regional teams.
	AI-Driven Adaptation Loops	AI analytics monitor team velocity and system performance, automatically recommending process or configuration adjustments.
	Outcome-Based OKRs	Agile teams set measurable objectives linked to customer or service outcomes rather than output volume, reinforcing value orientation.
Analysis of Hybrid Agile Project Management in the Telecommunications Industry (Aydin et al., 2025)	Adaptive Framework Customization	Agile frameworks are tailored using hybrid principles that, account for telecom-specific challenges, security, data protection, and scalability.
	Introduction of Bridging Roles (APL/DPL)	Custom roles act as mediators between PMs and Agile teams, facilitating cross-functional coordination and mitigating conflict.
	TOGAF-Aligned Governance	Incorporating TOGAF-based enterprise architecture helps standardize Agile practices and ensure cross-team cohesion.
	Servant and Disruptive Leadership	Leadership rotation and servant-style management empower Agile teams while ensuring oversight across distributed teams.
	Dedicated Agile Teams per Project	Assigning dedicated Agile teams (rather than shared resources) is recommended to enhance focus, reduce conflicts, and improve project velocity.

	Hybrid Coordination Tools	The Trex program and integrated PM-Agile dashboards enhance transparency and collaboration across departments.
	Scaled Agile Recalibration (SAFe, LeSS)	Selective application of SAFe or LeSS frameworks can better align multiple Agile teams across global telecom functions.
	Continuous Training & PMBOK Alignment	Aligning Agile training with PMBOK 7th Edition principles ensures smoother hybrid adoption in regulated telecom contexts.
<i>Methodology in, IT Telecommunication Projects: A Mixed Method Research Approach</i> (Adel & Fattah, 2020)	Contextual Adaptation of Agile Practices	Agile frameworks must be adjusted to telecom project contexts, considering complex infrastructure, long delivery cycles, and strict regulatory environments, to ensure effectiveness in global deployments.
	Management as Governance Enablers	Project managers in telecoms should act as facilitators and governance anchors rather than controllers, helping Agile teams align with strategic goals without micromanagement.
	Integration with Organizational Standards	Tailoring Agile requires blending it with existing frameworks like PMBOK or ITIL to maintain compliance and auditability across international subsidiaries.
	Cross-Functional Collaboration Models	Agile success in global telecom projects depends on sustained cross-functional collaboration, linking software, network engineering, and operations teams within shared sprints and ceremonies.
	Use of Hybrid Delivery Models	Hybrid frameworks (e.g., combining Kanban for maintenance and Scrum for innovation) support diverse telecom functions by balancing stability and flexibility.
	Continuous Stakeholder Feedback Loops	Regular customer involvement and daily communication enable iterative feedback, improving project outcomes and satisfaction across geographically dispersed clients.
	Data-Driven Evaluation and Learning	Performance metrics and retrospectives are used to assess Agile efficiency and tailor frameworks continuously, leading to better predictability and organizational learning in telecom environments.
<i>Secure Global Software Development: A Practitioners’ Perspective</i> (Humayun et al., 2023)	Literature-Grounded Framework Development	The framework begins by systematically identifying practices through scientific and grey literature, ensuring evidence-based inclusion of SSDLC measures.
	Phase-Based Categorization (SDLC Mapping)	Practices are categorized according to SDLC stages—requirements, design, coding, testing, and deployment—to align security tasks with lifecycle phases.
	Evaluation Based on Business Characteristics	In Step 3 of the framework, practices are assessed against business type, size, and context to ensure contextual adaptation in global environments.
	Organizational Repository for Reuse	The framework concludes with the storage of validated security practices in a centralized repository, enabling future reuse and standardization.
	Empirical Validation and Practitioner Involvement	The study integrates practitioner surveys to validate the relevance of practices (54 GSD experts), blending empirical and theoretical perspectives.

	Multi-Level Security Integration	Emphasizes “defense-in-depth” as part of the framework—embedding multi-layered protection mechanisms in distributed GSD environments.
	Iterative Refinement and Case Studies	The framework is designed to evolve through future case studies and real-world validation, supporting continuous improvement in secure GSDLC design.
	Context-Aware Framework Selection	No single framework fits all contexts; frameworks must be adapted to organizational size, maturity, and complexity (e.g., using SAFe for large enterprises, LeSS for leaner ones).
<i>Internet Technologies & Society and Sustainability. Technology and Edtication</i> <i>(Grundler & Westerner, 2019)</i>	Hybrid Portfolio Management (PPM + Agile)	Integrating Agile scaling mechanisms with traditional PPM ensures alignment between strategy and execution while maintaining flexibility in resource and budget allocation.
	Decentralized yet Aligned Structures	Effective tailoring requires balancing decentralized decision-making with strategic coherence through roles such as Lean Portfolio Management and Epic Owners in SAFe.
	Shift from Projects to Value Streams	Replacing projects with value streams encourages continuous delivery and customer-centric prioritization, which enhances responsiveness and product quality.
	Continuous Learning and Improvement Loops	All frameworks embed retrospectives, communities of practice, or continuous improvement cycles to foster organizational learning and process evolution.
	Scalable Coordination and Transparency Mechanisms	Kanban systems, Epic Progress Charts, and Portfolio Boards serve as scalable visualization tools for progress, dependencies, and performance metrics across programs.
	Cultural and Role Adaptation	Successful tailoring requires redefining managerial roles and encouraging a mindset of empowerment, transparency, and product ownership across global divisions.

Appendix J: Declaration of Authenticity

I hereby declare that I have completed this MIM Master's thesis on my own and without any additional external assistance. I have made use of only those sources and aids specified and I have listed all the sources from which I have extracted text and content. This thesis or parts thereof have never been presented to another examination board. I agree to a plagiarism check of my thesis via a plagiarism detection service.

This work was completed under the supervision of Prof. Dr. Thomas Bolz at IU International University of Applied Science as a requirement for the successful completion of the MA Master of Arts in International Management (MIM).

Sincerely,

Syed Mohammad Musharraf

Place, Date

Berlin, 24-11-2025

Signature

*Smm
Musharraf*
