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Project Risk Management in Large-Scale Digital Transformation Projects: A Qualitative Study of Major Finnish Telecom Operators

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ABSTRACT:

This study discusses the project-level risk management of large-scale digital transformation initiatives in the Finnish telecom providers. The study will examine the process of risk identification, assessment and management, and examine the performance of the project management practices and governance mechanisms in the complex transformation environments. The qualitative research design was employed, which entailed a systematic review of literature and semi-structured interviews with six professionals in the industry. Thematic analysis was used to analyse the data. The results indicate that the risks at the project level are multi-dimensional and structural to the complexity of the digital transformation, especially because of the integration of multi-systems, the presence of the old infrastructure, and the socio-technical interdependencies. Human and organisational risk factors turned out to be the most important, and there were technical and resource-related risks. It was found that risk management practices were iterative and adaptive, involving formal structures and informal experience-based approaches and continuous monitoring. Governance mechanisms are very important in the control of risks but their effectiveness depends on the structure of the organisation and the level of efficiency in decision-making. The research paper has its contribution to the theory and practice since it brings to attention the requirement of adaptive, integrated and humanistic risk management strategies in complex digital transformation initiatives.

KEYWORDS: Digital Transformation, Project Risk Management, Telecom Industry, Governance Mechanisms, Complex Project Systems

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1 Chapter 1: Introduction

1.1 Background and Context of the Study

Digital transformation has gone beyond a voluntary organisational undertaking to an obligatory objective, especially in developed telecommunications markets (Gharib, 2019). The global Information and Communication Technology (ICT) investment in 2024 was over USD 560.95 billion, of which about 45-50 per cent went towards digital transformation projects by telecom operators. This concentration of investment indicates a structural change in the logic of competition: value production is geared toward its capacity to repurpose digital structures, automate network processes, and provide data-driven, resilient services at scale. In digitally advanced economies, the inability to implement transformation efficiently ceases to be a peripheral inefficiency and an immediate danger to their continued operation and positioning (Warade, 2025).

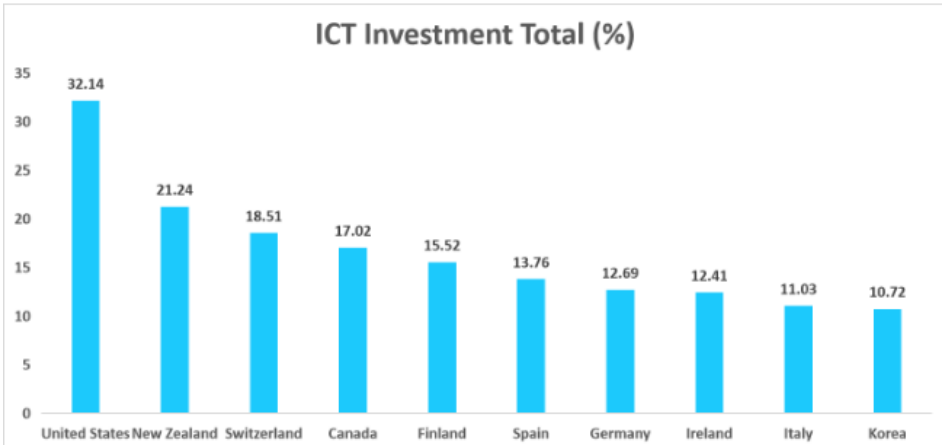

Figure 1: ICT Investment in Government Market Size (Warade, 2025)

Projects largely drive massive digital transformation in telecom organisations. Under normal circumstances, transformation programmes comprise several interdependent projects: core network modernisation, cloud migration, OSS/BSS replacement, and advanced analytics integration (Motamary, 2024). The evidence in the industry portfolio shows that key telecom operators invest in digital transformation portfolios, allocating 30% of annual CAPEX forward, with single projects worth between 10 and 50 million EUR and lasting 18-24 months (Taaffe, 2022). Whilst projectisation enables financial

management and accountability, it also introduces greater vulnerability to coordination and interface risks, as well as to cascading delays in tightly coupled project systems.

Digital transformation projects in the ICT and telecom sectors pose higher risks than traditional infrastructure projects. Such consequences are neither the result of single execution failures but rather the combination of the complexity of legacy systems, exposure to cyberattacks, regulatory limitations, and organisational change processes. The likelihood of operational incidents across migration stages in incumbent operators is two to three times higher because legacy OSS/BSS integration is directly linked to technical debt, which leads to operational incidents and subsequent project risk (Manda, 2024).

The Finnish telecom industry strengthens these dynamics. By 2024, Finland had achieved more than 98 per cent broadband penetration and 99.99% population coverage by 5G networks, making it one of the most digitally advanced EU economies (WorldData.info, 2026). The market consists of three operators, Elisa, Telia Finland, and DNA, which together hold more than 90 per cent of the national market share, making large-scale transformation projects systemically relevant. Digital transformation, in this case, is a risk domain for critical operations, potentially leading to national service, economic, and reputational impacts when project-level risk management fails (Capacity, 2025).

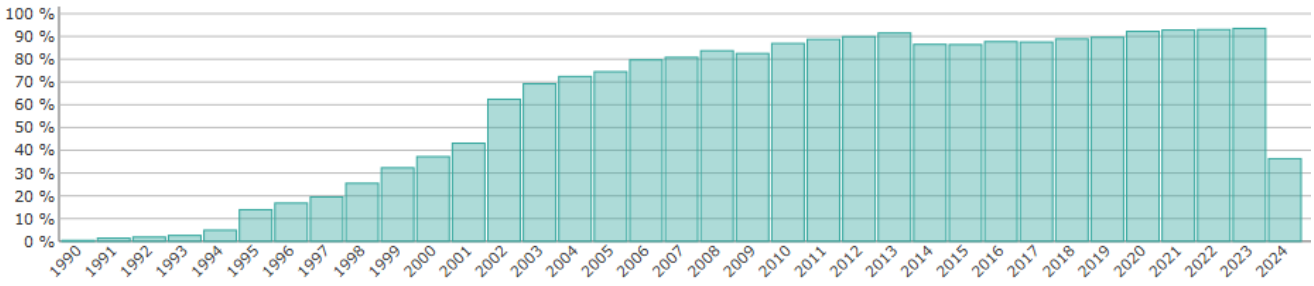

Figure 2: Access to the internet in Finland from 1990 – 2024 (WorldData.info, 2026)

1.2 Digital Transformation in the Telecom Industry

The telecom industry is systemic, highly capital-intensive, and infrastructure-critical, which characterises digital transformation. In contrast to digitalisation in peripheral service industries, telecom transformation directly affects national communications infrastructure, where the collapse or deterioration of performance has significant economic and social consequences (Dharanikota, 2017). By 2024, telecom operators worldwide had networks with data traffic volumes growing by 25-30 percent annually, driven by 5G, IoT, and cloud-based services. This acceleration demands continuous evolution rather than intermittent change, entrenching digital operations as a permanent state rather than a one-time motivation (Jafor et al., 2024).

The high specificity of assets and extended investment horizons characterise the large-scale ICT and digital-transformation environment within telecom organisations. Portfolio-level individual transformation programmes are typically over EUR 100 million and encompass several projects, including core network virtualisation, data platform integration, and network operations automation. High levels of interdependence characterise such environments: failures or delays in one system migration project often spread to billing, customer management, and network control services, significantly increasing the risk of execution outside the scope of any single project (McKinsey, 2025).

Old systems have a determinant influence on the transformation complexity. A significant amount of technical debt has been caused by many European telecom operators still relying on OSS / BSS platforms that have evolved over 20-30 years. Connection of these systems to cloud-native systems raises the chances of failure during migration stages by two to three times more than greenfield implementations. Regulatory requirements also limit operational leeway, as service continuity and data sovereignty legal requirements increase risk tolerance, thereby exacerbating the need for stringent project-level regulation in transformation programmes (Saeeda et al., 2024).

1.3 Project Risk Management in Digital Transformation Projects

The project-level risk in digital transformation projects extends beyond the time-honored cost and schedule uncertainties to encompass systemic, emergent, and interdependent risk dynamics. In more intricate digital projects, the risk is not solely the occurrence of single events, but a combination of technological uncertainty, organisational change, and external regulatory pressures (Kessler et al., 2023). Using empirical data, schedule overrun for digital transformation projects was found to be 40-60 percent in large-scale projects, and cost deviation was 15-30 percent, indicating that risk anticipation and control mechanisms remain ineffective (Gierszal, 2025).

Transformational risk management in projects is officially mandated in accepted governance frameworks. However, its actual implementation is often compromised by the speed and lack of clarity that come with digital transformation. Cascading risks from system interdependencies, vendor lock-in, or running projects in parallel are often absent from risk registers and periodic reviews. This makes risk management responsive rather than a strategy for mitigating and preventing risks, especially when projects are in advanced stages of implementation (Millard, 2023).

Conventional risk management strategies are not well-suited to the digital environment. Linear models of risk assessment assume constancy of needs and foreseeable interfaces, which are typically broken in transformation environments with changing architectures and repeated deployments. These constraints lead to later escalation of risk in telecom projects, where legacy integration, cybersecurity exposure, and regulatory compliance converge, and where managerial visibility is diminished. Thus, in the context of digital transformation, project-level risk management must be adjusted to the needs of risk transmission within networks of project systems, beyond the traditional boundaries used (Larionov et al., 2021).

1.4 Research Problem

Telecom industry digital transformation initiatives are typically carried out using a complex set of interrelated projects, such as network modernisation, cloud-based migration, and OSS/BSS system re-implementation (Motamary, 2024; McKinsey, 2025). These projects are characterized by high technological uncertainty, limitations of the legacy system, and regulatory control, thereby increasing the risk of schedule slippage, cost increases, and operational discontinuity (Gierszal, 2025; Saeeda et al., 2024).

Although the concept of digital transformation has been studied extensively through the lens of strategic and organisational dimensions (Gharib, 2019), empirical evidence suggests that transformation failures occur more often at the project implementation phase than at the strategic intention level (Kessler et al., 2023). Project-level risk can have systemic operational implications for a highly regulated, infrastructure-critical industry like telecommunications (Dharanikota, 2017). Nonetheless, the literature at hand is geared towards transformation strategies, models of digital maturity, or governance frameworks, with comparatively little emphasis on the processes of risk identification, risk analysis, and risk mitigation at the project level in digital progress countries.

High levels of digital maturity, almost complete coverage of the population with broadband services, and a concentrated telecom market structure are characteristic features of the Finnish telecom environment; thus, massive change initiatives are the order of the day at the operational level (WorldData.info, 2026). This notwithstanding, there has been only a paucity of qualitative research on project-level risk management practices among Finnish telecom operators. This creates a disjuncture between strategic transformation discourse and the realities of risk governance in the project's practical implementation.

To overcome this gap, one needs to adopt a project management approach, as risks become real and are managed mostly at the project level, where decision-making structures, control mechanisms, and managerial practices play a direct role in determining the results of the transformation.

1.5 Research Aim and Objectives

This study aims to analyse risk handling in large-scale digital transformation projects at the largest Finnish telecom operators and to evaluate the impact of project management practices on risk management.

To achieve this aim, the study pursues the following objectives:

a. To identify the key project-level risks associated with large-scale digital transformation initiatives in the Finnish telecom sector.
b. To analyse how these risks are assessed and prioritised during different stages of project execution.
c. To examine the effectiveness of project management practices and governance mechanisms in mitigating identified risks.
d. To develop project management–focused recommendations for improving risk mitigation in future digital transformation projects.

1.6 Research Question

The central research question guiding this study is:

"How are project-level risks managed in large-scale digital transformation projects within major Finnish telecom operators?"

This research question directly aligns with the study's aim and objectives. It will be answered using a qualitative research method that allows for exploring the project's risk dynamics and management practices in depth within a complex digital transformation environment.

1.7 Scope and Delimitations of the Study

The scope of this study includes Finland's major telecom operators, i.e., organisations that manage both national-scale fixed and mobile network infrastructure in Finland. The

strategic and systemic significance of these operators is reflected in the organisational focus, where the digital transformation programmes directly influence ties between countries, service continuity, and the scale of regulatory requirements. The analysis does not examine small digital transformation projects, equipment sellers, or global subsidiaries, as the environments of such projects and their risk exposures vary significantly. Daily IT upgrades, system enhancements, and operational maintenance projects are excluded because they are less strategically risky, interdependent, or organisationally impactful.

The study employs a qualitative research approach and enables in-depth analysis of risk identification, assessment, and mitigation practices at the project level. Quantitative performance measurement, financial modelling, and statistical hypothesis testing are out of scope because the aim of the research is interpretive rather than predictive. The project management perspective also narrows the scope of the research. The formulation of digital policies at the strategic level, their effects on macroeconomics, and the design of technology are not discussed in detail. It is based on the fact that risks materialise and are managed throughout the project implementation process; this is where governance structures and managerial decisions have the most direct effect on transformational results.

1.8 Significance of the Study

1.8.1 Academic Significance

This research develops the literature on project management and digital transformation by addressing an empirical gap that has persisted since the inception of the project-level transformation discourse and the realities of project execution. Although the issue of digital transformation is widely studied at strategic and organisational levels, there is a dearth of empirical knowledge about how risks can be addressed in large-scale transformation projects, especially in highly digitalised and regulated settings. By paying attention to the project-level risk dynamics of the Finnish telecom operators, the work contributes to advancing digital transformation research by moving in one direction towards

established research on project management, where failure or success is defined operationally. It provides context-specific data from a Nordic telecommunications setting, which is underrepresented in existing empirical data and is especially accentuated in multinational or less-regulated industries. Subsequently, the study serves to refine a theory by showing how project risk management practices can operate under extreme levels of digital maturity, regulatory constraints, and infrastructural criticality.

1.8.2 Practical Significance

In practise, the research can provide practical implications for project managers, programme leaders, and transformation sponsors responsible for implementing complex digital projects. The findings assist in better anticipating risks, their escalation, and the design of their governance by detecting key project-level risks and assessing the practise of mitigating them. It also enlightens decision-makers within the organisation, as the study reveals how project management practise can enhance the reliability of transformation, thereby implementing digital changes more resiliently and under greater control.

1.9 Structure of the Thesis

This thesis is organised to deliver a consistent, logical, progressive analysis of project risk management in massive digital transformation projects. In chapter 1, the research setting, problem, purpose, scope, and significance are presented to provide the basis and dominant justification for the study. Chapter 2 serves as a critical review of the related literature, with particular attention to the concepts of digital transformation, project risk management, and governance, and concludes by presenting the conceptual framework for the analysis. Chapter 3 describes the research methodology and covers the qualitative study research design, data collection strategy, and the analysis processes used to investigate risk dynamics at the project level. There should also be ethical concerns and methodological constraints to maintain research rigour and transparency. In Chapter 4, the empirical results are organised around the major themes of identification, analysis, mitigation, and governance practices in digital transformation projects, assessing both

theoretical and practical implications. Lastly, Chapter 6 will conclude the thesis with a summary of the major knowledge, contributions to knowledge and practise, limitations, and suggestions for how the research may be used in the future. This format enables the level of analysis, methodological precision, and congruence with the study's research objectives.

2 Chapter 2: Literature Review

2.1 Introduction to the Literature Review

This chapter is a critical review of the academic literature on project-level risk management in large-scale digital transformation projects in big telecom operators. Although digital transformation has been widely studied at strategic and organisational scales, less attention has been paid to risk identification, analysis, and mitigation during project execution in critical infrastructure settings. The three theoretical underpinnings of digital transformation risk and complexity, project risk management (PRM) theory, and governance in complex project systems are used to fill this gap by structuring the review. These structures are chosen because they directly inform ideas about how risks come into being, how they are structured, and how they are managed at the project level. It is descriptive, but only in a negative way, as the review examines recent academic achievements and their weaknesses in covering risk dynamics at the project level in situations of telecom transformation. The chapter goes on to consider each framework separately, then synthesise them to identify the research gap that will inform this study.

2.2 Digital Transformation Risk in Infrastructure-Intensive Industries

Telecom digital transformation operates within an infrastructure-priority, tightly coupled system in which technological transformation directly affects national connectivity and service availability. A combination of legacy integration, regulatory restraint, and architecturally interdependent environments poses a structurally high-risk transformation environment.

2.2.1 Digital Transformation as Systemic Change

Digital transformation (DT) is broadly understood as a socio-technical process that is implicitly restructuring technological architectures, organisational practices, and mechanisms of value creation (Vial, 2019). The transformation in telecom is large-scale and

involves intensive structural changes in the basic network infrastructure, operations support systems (OSS), and business support systems (BSS), as well as data governance constructs, rather than incremental IT upgrades. Not only are technical systems affected by such a transformation, but managerial processes, decision-making rights, and organisational capabilities are also (Warner and Wager, 2019).

DT introduces increased system complexity in infrastructure-intensive sectors. Telecommunication networks are highly interdependent socio-technical systems whose interdependencies on their components increase susceptibility to cascading failure (cf. Perrow's (1984) normal accident theory). Much of the technical debt and architectural inflexibility of legacy systems also makes integration with cloud-native or virtualised systems a particularly risky endeavour (Saeeda, Ahmad & Gustavsson, 2024, Proceedings of the ACM/IEEE International Conference on Technical Debt). Digital platform transformation empirical research demonstrates that, when it comes to legacy-modern integration, there is a significant rise in uncertainty at the migration and deployment stages (Sebastian et al., 2017).

Also, the nature of risk in digital transformation projects is usually emergent. Contrary to the usual infrastructure undertaking, where risk can be predicted to a large extent, digital transformation is characterized by changing needs, cybersecurity vulnerabilities, reliance on vendor ecosystems, and adaptation to regulations. Elliott and Stead (2017) claim that digital change introduces instability into existing institutional orders and creates a condition of uncertainty that can be fully specified only ex post. It is these three conjunctions of socio-technical disruption of the legacy and alongside emergent uncertainty that make telecom digital transformation structurally high-risk and require an adaptive mechanism of project-level risk governance.

2.2.2 Digital Transformation Risk in Infrastructure-Intensive Industries

2.2.2.1 Digital Transformation as Systemic Change

The idea of digital transformation (DT) in infrastructure-intensive sectors is increasingly perceived as a socio-technical rearrangement of systems rather than a technological

invention. According to Vial (2019), DT is a process, which initiates sea changes in organisational structures, value creation logics and technological architectures. These transformations are usually in the telecom settings, and it may include network virtualisation, cloud migration, replacement of the OSS / BSS, and integration of data platforms, all of which impact both technical systems and organisational processes.

According to the socio-technical systems theory by Trist & Bamforth (1951), technological and social subsystems are interwoven and as such, the transformation of the digital architecture is bound to transform workflow and governance structures, as well as decision-making practices. In telecom organisations, decades of developed legacy and infrastructures bring about both architectural rigidity and even complexity of integration. Empirical studies of digital platform transformation indicate an increased uncertainty level during the migration stages by existing standards, data fragmentation, and undocumented dependency (Vadlamani, 2024).

2.2.2.2 Risk Characteristics in Telecom Transformation

The 4 characteristics of risk in telecom digital transformation projects include the special risk attributes of technical debt, regulatory risk, service continuity, and the behavior of cascading failures. Specifically, the accumulated impact of past design and architectural choices is what is referred to as technical debt, which is especially severe in infrastructures that have been running long enough (Vriezekolk, 2016). Existing OSS/BSS systems are not usually modular and documented, which compounds the risk of uncertainty in migration and integration risk in the process of transformation projects.

Exposure to regulations also increases levels of risks. Telecommunication is regulated at the strict national and EU-level under the national and EU-level regulations on data sovereignty, cybersecurity, and the availability of the services (Da Ponte et al., 2022). Research in ICT governance suggests that regulatory restrictions reduce experimentation and tolerance to the errorableness of implementation, leading to higher operational impacts of failure in digital infrastructure projects (Henningsson & Eaton, 2022). This embeddedness regulation makes the digital transformation a compliance sensitive exercise.

Continuity risks: Service Continuity risks are especially urgent in the case of telecom. This is in contrast to other sectors of the economy, where peripheral IT systems support the national network for connectivity and the emergency communication network. A study on the resilience of critical infrastructure shows that upgrades to digital systems can render infrastructure susceptible in the short term during transition periods, when the current and previous systems coexist (Flammini, 2019).

Besides, the dynamics of cascading failures exacerbate the risk at the project level. Close network associates imply that errors caused by changes can spread to both technical and organisational levels. Research on complex systems and ICT system resilience demonstrates that massive interdependence raises the likelihood of systemic breakdown in the occurrence of uncertainty (Buldyrev et al., 2010).

2.3 Project Risk Management (PRM) Theory

Project Risk Management (PRM) theory (Project Management Institute [PMI], 1996; Hillson, 2002) offers a systematic approach to identifying, analyzing, and managing uncertainty in a project. Based on formal project management guidelines, such as the PMBOK framework developed by the Project Management Institute (PMI, 2021) and ISO 31000 (ISO, 2018), PRM conceptualises risk as identifiable events that can be systematically evaluated and averted. Classical PRM presupposes that uncertainties can be minimized through clearly defined processes and managerial control tools.

2.3.1 Traditional PRM Models

Project Risk Management (PRM) theory defines risk as a manageable, discrete phenomenon, institutionalised within structured project governance processes. According to the PMO Guide (PMI, 2021), project risk management is a cyclical process that includes risk identification, qualitative and quantitative risk analysis, risk response planning, and risk monitoring and control. The existence of this preset order is based on the assumption that potential threats and opportunities can be planned regularly and monitored throughout implementation.

In line with this, ISO 31000 (International Organization for Standardization [ISO], 2018) establishes the principles of risk management based on context establishment, risk assessment, treatment, communication, and monitoring. The two structures focus on documentation tools including risk registers, probability-impact matrices and mitigation plans. The objectives of these mechanisms are to increase transparency, accountability and predictability in project environments.

The traditional PRM models are based on assumption of relative stability in the environment. Risks are managed as foreseeable occurrences reflecting quantifiable likelihoods, and a good governance is anticipated to minimize difference among speculated and actual results. These models are suitably applicable to engineering or construction projects, which are defined in terms of scope, and are technically clear (Raydugin, 2025). This well-defined predictability however is more problematic in settings where requirements change dynamically University and context of interdependence increases uncertainty.

2.3.2 Limitations of PRM in Complex Digital Projects

Traditional PRM assumptions are put more and more into question when working in complicated digital transformation projects. Big digital programs have emergent risk properties that are not always ready to be spotted at the initial stages of the planning. As Kessler, Rosca, and Arlinghaus (2023) show, technological and task uncertainty are modifying managerial risk reaction processes rather than proactive responses in digital situations, rendering risk management more of a reactive than a proactive process.

Another bias noted in megaproject literature like Prater et al. (2017) is systematic optimism bias whereby project planners lower estimates of costs, time and technical difficulty. Optimism bias is increased in the context of digital transformation due to the fast-paced technological change and the adjusting expectations of the stakeholders. As a result, formal risk assessment can create an illusion of control, but not reducing the uncertainty.

The effectiveness of static risk registers is also compromised by dynamic uncertainty. Digital projects often entail iteration, vendor ecosystem dependencies, exposure to cybersecurity risks, and changing regulatory demands. These causes create relational and systemic risks, not event-based risks. Studies on complex project systems suggest that tightly interdependent subsystems can spread interface failures throughout the system, and that linear mitigation planning alone would not be sufficient (Maylor, Vidgen, and Carver, 2008).

Consequently, researchers are calling for greater attention to adaptive and resilience-based risk management strategies that focus on ongoing learning, flexible governance, and real-time monitoring rather than on largely predictive control (Hillson and Murray-Webster, 2017). This change indicates a transition away from risk prediction toward uncertainty negotiation.

As the digital transformation of telecom infrastructure is critically important and regulations restrict practices, it becomes imperative to study PRM practices in this context. Substantial frameworks are available, but their application in the context of large-scale telecom digital transformation projects has not been extensively researched, which is directly related to the research problem of the present study.

2.4 Governance and Control in Complex Project Systems

The ways the decisions are made, risks are escalated, and accountability is organized in the complex project environments depend on the governance and control mechanisms. Governance arrangements determine how uncertainty is monitored and mitigated through large-scale transformation programmes that consist of several interdependent projects. Successful governance thus serves as a structural process that creates an interconnection between exposure to risk at the project level and organisational outcome.

2.4.1 Project Governance Structures

Project governance is a framework of decision rights, accountability structures, and controls within which project execution is guided. Governance in sophisticated digital transformation programmes can contextualize beyond particular project management practices to portfolio-level coordination, strategic control, and stakeholder alignment (Müller et al., 2016).

Decision rights are a key component of governance. Kiral (2025) also claims that well-articulated authority frameworks minimize ambiguity in projects with high uncertainty and improve prompt response to risky situations. Clarity in decision-making boundaries can slow down mitigation efforts in digital transformation scenarios and increase uncertainty due to changing scope and requirements. Good governance in this case requires formal steering committees, executive sponsorship, and accountability channels.

Another critical dimension is the escalation mechanisms. Complex projects often encounter problems beyond their operational scope. Governance structures provide formal channels for escalating emerging risks to relevant management levels. Glaser and Risius (2016) emphasize that structured upward social movements positively influence transparency levels and reduce political distortion in portfolio settings.

It is also important to have portfolio coordination. Digital transformation programmes are usually multiple projects that run simultaneously, sharing resources and technical interfaces. The governance processes need to synchronize priorities, resolve resource tensions, and align interdependent workstreams. In the absence of this coordination, local project-level optimisation can lead to systemic inefficiency (Jiang, 2023).

Lastly, interface management is also an important factor in infrastructure-intensive industries. Formal oversight is necessary to ensure that all technical and organisational interfaces between vendors, legacy systems, and operational units are not misaligned. Poor interface governance often causes cost overruns and the failure to integrate complex projects successfully (Zhang et al., 2022).

2.4.2 Risk Propagation in Interdependent Projects

Large-scale digital transformation programmes can be conceptualised as a project system composed of strongly tied, mutually dependent initiatives. In this type of system, risks do not exist in isolation but rather spread across interfaces, with cascading effects. Project systems theory suggests that interdependencies augment managerial complexity and diminish predictability, especially when both technical architectures and organisational structures are reconfigured concurrently (Jöhnk et al., 2020).

The telecom sector is particularly vulnerable to cascading risk dynamics due to tight integration among network, billing, and customer management systems. Performance will be exposed to failure or delay in any one subsystem, thereby increasing operational impact. Complex systems studies and analyses of infrastructure resilience show that closely integrated systems are more easily disrupted systemically under uncertainty (Chen et al., 2021).

The complexity of the vendor ecosystem also increases the risks of propagation. The digital transformation often involves various technology vendors, cloud and service providers, and integrators (Borangiu et al., 2019). Research such as that by Tannir et al. (2023) on inter-organisational project governance indicates that accountability fragmentation and contract ambiguity can intensify the risk of coordination failure and slow the mitigation response. When vendor responsibilities overlap at interfaces, risk visibility can be diluted.

Regulatory restrictions in the telecom settings compound these dynamics. Telecom is subject to stringent regulations on service continuity and data protection, and as such, an experiment can be limited, with significant effects from disruption. Government systems should thus strike a balance between innovation and compliance control (Wang, 2024).

In general, within interdependent project systems, governance serves as a coordinating architecture that defines how risks are identified, escalated, and mitigated. It is a

mediating factor between structural risk exposures and project returns. This mediating role is vital for understanding the effectiveness of project-level risk management in large-scale telecom digital transformation, which is directly associated with the research problem in this study.

2.5 Synthesis of Literature and Identification of Research Gap

The literature review indicates that digital transformation (DT) studies provide a meaningful understanding of the structural ambiguity and complexity associated with the massive technological change. Research operationalises DT as socio-technical, systemic reconfigurability, which creates interdependency, architectural unsteadiness, and emergent risk process (Vial, 2019; Warner & Wager, 2019). Exposure to operational disruption is also heightened in infrastructure-heavy industries, especially the telecommunications industry, when there is legacy integration and regulatory embeddedness. Therefore, it is clear that the proposed transformation environments are high-risk, as explained in the DT literature.

Mechanisms for dealing with uncertainty, on the other hand, are presented in the Project Risk Management (PRM) theory. Consistency frameworks such as PMBOK (PMI, 2021) and ISO 31000 (ISO, 2018) specify systematic levels for identifying, analyzing, mitigating, and monitoring risks. Though critical scholarship also points out shortcomings of such models in complex and dynamic contexts, in which emergent risks, optimistic bias, and unfavorable dynamics among interdependencies disrupt predictive planning assumptions (Flyvbjerg, 2014; Kessler et al., 2023). PRM literature thus describes how risks are to be managed formally while remaining mindful of contextual realities.

Governance studies provide a structural layer, showing how the rights to make decisions, the mechanisms of escalation, and the control of risks within complex project systems (Chen et al., 2021; Elliott & Stead, 2017). Governance functions as organisational architecture in terms of risk disclosure and reaction potential.

All these contributions notwithstanding, the three streams are still highly disjointed. The strategic transformation theme in the literature on DTS is connected to the procedural control theme in PRM theory, and to the structural coordination theme in research on governance deals. The under-researched area is the intersection of these dimensions on the ground in large-scale telecom digital transformation programmes at the project level. Project-level risk management is critical in the Finnish telecom sector, which has a high level of digital maturity, a narrow industry structure, and a rigorous regulatory environment. Nonetheless, empirical qualitative studies on how risks are identified, examined, and alleviated in this environment are scarce. This paper fills such an integrative void.

2.6 Conceptual Framework of the Study

Based on the literature review above, this research paper employs a combined conceptual framework that integrates the complexities of digital transformation, project risk management (PRM) processes, and governance mechanisms. The model suggests that extensive digital transformation in telecom settings creates structural and emergent risks related to socio-technical interdependence, prior incorporation, and control limitations. These situational conditions form the major cause of project-level uncertainty.

These risks are addressed through the formal mechanisms organisations use to organise and manage them via PRM processes, such as risk identification, qualitative and quantitative analyses, mitigation planning, and monitoring (PMI, 2021; ISO, 2018). These processes, however, are not presupposed to work effectively; they are affected by governance arrangements that define decision rights, escalation channels, portfolio coordination, and interface management (Vriezekolk, 2016). Governance, as such, is a mediating element between the possible implementation of these dangers and their escalation into operational interference.

The study's empirical design follows this conceptual integration. The interview question is designed based on three examination areas, namely (1) sources and nature of project-level risks in digital transformation projects; (2) the application of PRM tools and processes in practice during the implementation; and (3) governance arrangements that

affect the levels of risk visibility, escalation, and mitigation efficacy. The data collection thus looks into the formal, managerial, and inter-project coordination processes.

Chapter 4 will present the analytical findings on these three dimensions, enabling a systematic investigation of the role of digital complexity in producing risk, the efforts of PRM processes to overcome it, and the role of governance mechanisms in the consequences of Finnish telecom digital transformation projects.

2.7 Summary of the chapter

This chapter critically examined the literature pertinent to project-level risk management in a large-scale digitization project. It revealed that socio-technical complexity, legacy integration, and regulatory exposure produce systemic and emergent risks within the telecom environment during digital transformation. Project Risk Management (PRM) theory offers predictive frameworks for addressing uncertainty, but its conventional methods often fail in volatile digital environments. Governance research has also indicated that decision rights, escalation mechanisms, and portfolio coordination affect risk control in interdependent project systems. The gap in the synthesis was the lack of integrated, project-level empirical research on telecom transformation in the Finnish case, which this study addresses.

3 Chapter 3 – Methodology

3.1 Introduction of the chapter

In this chapter, the methodological approach for exploring risk management at the project level in large-scale digital transformation projects of telecom companies is outlined. It outlines the research design, unit of analysis, data sources, data collection, and data analysis procedures. It follows a systematic literature review, coupled with semi-structured interviews with experts, to ensure rigorous and replicable outcomes.

3.2 Research Design

The proposed study employs an exploratory qualitative research design (Ward et al., 2018) to examine project-level risk management in the telecom industry for large-scale digital transformation projects. The study combines a Systematic Literature Review (SLR) with semi-structured interviews with experts to ensure both theoretical and empirical coverage. The SLR will be used to determine current knowledge, theory, and typical risk types related to digital transformation and project risk management. The conceptual framework used in this study is based on the findings of the literature review. The semi-structured interviews with telecom project professionals will provide empirical insight into how risks are identified, analysed, and mitigated in practice. The combination of the two approaches enables analysis and validation of theoretical ideas from the literature through practical experience in the real project environment (Gaborov et al., 2024).

3.3 Unit of Analysis

The unit of analysis in this study is the risk management practices at the project level in major digital transformation projects in Finnish telecom organisations. The study specifically addresses the identification, analysis, and reduction of risks in project implementation. The focus of the analysis is thus on the process of operational project management, not on the wider corporate strategy or the behaviour of a single employee. By focusing on the level of project implementation, the study will examine how risk

management practices operate in complex transformation settings. The units of observation are the professionals directly involved in digital transformation projects. These will comprise project managers, programme managers, risk managers, and governance leads with appropriate experience in managing project risks in telecom organisations.

3.4 Secondary Data: Systematic Literature Review

A systematic literature review (SLR) was also conducted to identify and examine the scholarly literature on the research topics of digital transformation risk, project risk management, and governance in complex projects. Google Scholar, Scopus, and Web of Science were the primary academic databases used for the literature search (Martín-Martín et al., 2018). The search keywords comprised digital transformation risk, project risk management, telecom digital transformation, project governance, and complex project systems. To ensure the search was relevant and high quality, only peer-reviewed academic journal articles in English published since 2016 were included.

The refinement of the literature selection was done using clear inclusion and exclusion criteria. Studies included addressed digital transformation, project risk management, governance mechanisms, and telecom or infrastructure transformation contexts. Blogs that were not peer-reviewed, unrelated IT management research papers, and pure technical telecom engineering papers were filtered out. The identified studies were analysed using thematic synthesis to identify critical themes: risk sources, PRM processes, governance mechanisms, and risk propagation. These results inspired the conceptual framework in Chapter 2.

3.5 Primary Data Collection: Semi-Structured Interviews

The primary data used in this study are semi-structured interviews (Adeoye - Olatunde & Olenik, 2021) with professionals engaged in digital transformation projects in the telecom industry (See Appendix 1). These professional interviews provide invaluable experience in identifying, analyzing, and avoiding project-level risks during the implementation of large-scale transformation initiatives. The interviewees will consist of project

managers, programme managers, risk managers, and governance professionals with direct experience in the digital transformation project management. Purposive sampling is used, and participants are selected who have relevant expertise and experience (Campbell et al., 2020). The selection of respondents is based on their direct involvement in telecom digital transformation projects and participation in project management or risk management. This will make the data gathered to capture informed views of individuals involved in the projects during execution.

Between eight and twelve participants will be expected to be interviewed. The interview will be semi-structured around a set of questions that will guide the interview and allow for deeper exploration of participants' experiences. Some of the critical issues discussed in the interviews include how project-level risks are identified, risk mitigation practices, the mechanisms governing risk escalation, and the challenges of managing complex projects amid the evolving telecom landscape. The interviews will take place via online video meeting systems, and each session is likely to last about 30 to 45 minutes.

3.6 Data Analysis Method

The interview data will be analysed using thematic analysis to identify patterns and insights (Ahmed et al., 2025) into risk management at the project level in telecom digital transformation projects. To start with, the interview recordings will be transcribed to provide accurate records of the participants' responses. The transcripts shall then be read and coded to express pertinent concepts and categories. In this coding process, common themes regarding risk identification, risk mitigation practices, and risk governance mechanisms will be identified. The identified themes will be systematically mapped against the conceptual framework built following the literature review. Lastly, the results of the interviews will be compared with empirical findings from the literature to determine conformity, divergence, and the empirical implications of the observations regarding the practices of project risk management.

3.7 Ethical Considerations

During the research process, ethical principles are also taken into consideration to protect the integrity of the study. All participants will be informed of the research objective, and they will give informed consent before participating in the interviews. All the respondents will remain confidential and anonymous, and no personal or organisational identities will be released during the research. The results of interviews will not be shared with third parties, as they are intended solely for academic research. All information obtained will be stored securely and processed in accordance with the university's research ethics principles.

3.8 Chapter Summary

This chapter explained the methodology applied in this study. It described the qualitative research design, unit of analysis, and that a systematic literature review and semi-structured interviews would be used to collect data. The thematic analysis process and the ethical considerations that will guide the research were also described in the chapter.

4 Chapter 4: Results

4.1 Introduction

This chapter gives the empirical results of primary data collected in this research. The analysis presented in this chapter is grounded on the methodological approach described in Chapter 3, as semi-structured interviews that will be completed by professionals engaged in telecom digital transformation projects. The results are also specific to the project-level risk management practices and in the analysis of the risk identification, management, and governance of the complex transformation environments. A thematic analysis method was used to sort out and interpret data into some significant trends. To protect confidentiality, all participants are anonymised and identified by coded identifiers (P1-P6), and comprehensive information about the participants is provided in Appendix 2.

4.2 Participant Profile (Demographics of Interviewees)

4.2.1 Professional Roles of Participants

The sample used in this study is diverse in terms of the occupations of the participants; there are Project Managers, Senior Project Managers, Developers, a Managing Director and organisational or capability leads. Everyone is either directly engaged in planning, implementation, or facilitating digital transformation initiatives in telecommunication settings. This diversity guarantees that the results are representative of various functional views, which span both technical implementation and strategic oversight, which enhances the richness and validity of the information on project level risk management practices.

4.2.2 Industry Position and Organisational Context

The sample size included telecom operator organisations and supplier or vendor firms that were part of the telecom ecosystem. This difference is significant because it will include the views of not only service providers but also technology partners. This variation allows a greater insight into the operation of risk management practices across

organisational borders. It also indicates the interdependence aspect of telecom digital transformation projects, in which several parties work together, thus offering ecosystem-level information on how to handle project-level risks.

4.2.3 Experience in Digital Transformation Projects

All members have extensive experience in digital transformation projects, and they have been involved in system integration, automation programs, as well as organisational change programs. They have experience at various levels of project implementation such as planning, development and implementation. This will make sure that the data will capture the practice exposure to actual project situations as opposed to theory. The diversity of types of projects also enhances the results by obtaining risk management practices in varied transformation settings in the telecom industry.

4.3 Data Preparation and Analytical Approach

Interview tape records were transcribed so as to have a precise and full picture of the participant responses. After the transcription, the data were revisited several times to aid familiarisation and to determine initial observations pertinent to risk management at the project level. This was followed by an open coding process where key statements were coded and grouped into preliminary codes. These codes were then classified into bigger groups and this allowed the formulation of higher-level themes. The analysis entailed a repetition comparison of responses by different participants to ascertain reliability and consistency. Cross-validation of recurring patterns took place and discrepancies were addressed so as to ensure the rigour of analysis. This cyclic procedure made sure that the results were logically obtained and were always indicative of the views expressed by the participants.

4.4 Thematic Analysis Process

4.4.1 Analytical Procedure

The thematic analysis was a systematic and repetitive process. Firstly, familiarisation of data was done by repeated reading of the transcripts of the interviews to have a thorough understanding of participant responses. Second, the first coding was done through the identification of key statements and descriptive labels of the data in the relevant parts. Third, these codes were analyzed and clustered in order to come up with larger themes that represent common patterns among the participants. Lastly, theme refinement was also done to guarantee clarity, coherence and uniqueness of themes. It was done through the process of reviewing and revising theme boundaries in order to be accurate reflection of the data yet ensure internal consistency and focus of analysis.

4.4.2 Identified Themes

The thematic analysis led to four main themes which represent the most important dimensions of risk management at project level in telecom digital transformation projects. These are: Digital Transformation Complexity as the Structural Source of Risk; Nature of Project-Level Risk as Emergent and Multi-Dimensional; Project Risk Management Practices as Adaptive and Iterative and Governance and Risk Control Mechanisms. The themes are each a grouping of similar patterns found in the responses of participants. These themes give a systematic way of presenting the findings and are discussed in the sections below in greater detail to bring out their importance and relationship.

Table 1: Thematic Structure and Categorisation

Theme	**Key Dimensions (Integrated)**	**Analytical Focus**
Digital Transformation Complexity as the Structural Source of Risk	Multi-system integration, legacy systems, socio-technical complexity, organisational and contractual factors	Complexity is embedded within interconnected systems, legacy constraints, and organisational structures, creating continuous

		exposure to risk during transformation
Nature of Project-Level Risk	Technical risks (integration, data, performance), human risks (skills, resistance, resource loss), resource constraints (budget, time, capacity), temporal dynamics (early, testing, continuous, post-implementation)	Risk is multi-dimensional, combining technical, human, and organisational factors, and evolves dynamically across different stages of the project lifecycle
Project Risk Management Practices	Formal approaches (probability-impact matrix, risk scoring), informal practices (weekly discussions, experience-based decisions), continuous monitoring, mitigation strategies (testing, breakdown, rollback, communication), risk acceptance	Risk management operates as a hybrid system, combining structured tools with adaptive and iterative practices, where monitoring and mitigation are continuous rather than static
Governance and Risk Control Mechanisms	Escalation structures (project to steering committee), decision-making roles, governance variations (formal vs flat), challenges (delays, misalignment), risk propagation across systems	Governance functions as a control and coordination mechanism, but its effectiveness is shaped by organisational structure, decision speed, and interdependencies across projects

4.5 Theme 1: Digital Transformation Complexity as the Structural Source of Risk

The nature of digital transformation projects at telecom organisations is always typified by a high degree of structural complexity, which has a direct influence on the way risks are created, develop and interrelate over the lifecycle of the project. This complexity cannot be limited to only one dimension but manifests through the interplay of multi-

system integration, legacy infrastructure, socio-technical dynamics, and organisational and contractual structures. One of the main factors that contribute to this complexity is the size and complexity of system integration. Respondents stress that change is not about individual changes in technology but about several interconnected systems. As P1 explains:

"That widely depends on the area, but as we are building, uh, nationwide or worldwide, uh, networks, uh, with the like idea system needs with like. We are not talking about one system. We are talking about tens or hundreds of different systems. So, the integration is really, really deep, so the transformations are critical to keep all the critical networks up and running. In case of change or like transformation, so I would say that they are heavily complex. At least when we are talking about like the really, really main systems we are talking about."

This emphasizes the fact that change functions in a very interdependent system, where a small change can spread among various parts. In their support, P6 says:

"*Digital transformation projects are highly complex because they involve integrating multiple systems, handling a large volume of customer data and ensuring real-time processing and system reliability."*

It means that the complexity is further complicated by the necessity to deal with massive data flows and real-time system performance, which makes tolerance to errors lower and operational risk more apparent. The other vital aspect of complexity is the existence of legacy systems. Instead of overhauling the systems, transformation projects need to incorporate new technologies into the systems that have been established. P4 notes:

"And one of the key reasons is that most of these telecom companies have been around for quite some time, which has left us, I suppose, all of us, with a substantial amount of legacy systems".

This is indicative of a structurally constrained space in which change is overlaid on top of existing structures. Likewise, P2 discusses the problem of continuity of operations in change:

"It's, like, pretty complex, usually, and multidimensional. But it doesn't come from the technology alone, but it's usually the combination of legacy environments."

The presence of both old and new systems causes parallel functioning structures, which add a lot of complexity and unpredictability to the integration. Significantly, the results show the complexity is not just limited to technical systems, but is socio-technical in nature. This implies that stakeholder behaviour, organisational processes and user adaptation are the main human factors that influence the complexity of the project. This implies that there are other levels of complexity that come with contractual diversity and the difference in customer requirements and especially in telecom settings where products and services are highly differentiated.

The results prove that the complexity of digital transformation in telecom projects is a multi-layered and constant evolution of technical integration issues, legacy limitations and socio-organisational, thus serving as an unremitting structural source of project-level risk.

4.6 Theme 2: Nature of Project-Level Risk

4.6.1 Technical and System Risks

Technical and system related risks become one of the crucial dimensions of project level risk, mainly because of the complexity of the integration of the several systems that are interrelated. The participants continue to mention that integration problems cause uncertainty, with incompatibilities between systems potentially causing a breakdown in the overall performance of the project. Among the most common problems, according to P6, are system integration problems, data quality problems, bottlenecks to performance.

"According to me, at the project level, common risks are common, including system integration issues, data quality problems, performance bottlenecks and dependency on third-party rules."

These risks are interlinked and not independent, and in this case, the failure of one system can affect others in the project environment. Risks associated with data aggravate this difficulty. Data reliability and availability have a direct impact on the system functionality and the decision-making processes. P1 underlines this by mentioning the fact that

"In all kinds of projects, you have pretty much the same risks always, and the biggest risk is human beings, that the people are always, I think, the biggest risk in the project, because you may lose people."

The greatest danger is that we are not getting the right data. This will result in chaos, and it shows how terrible a failure of data can be. Moreover, there are performance risks due to high-demand environments where systems have to perform real time. These results show that technical risks are inherent in system architecture and are constantly influenced by integration complexity and data dependencies.

4.6.2 Human and Organisational Risks

Among the most prevalent categories found in the data is human and organisational risks. These risks can be mainly linked to behavioural aspects, the availability of skills, and the coordination of the stakeholders. This is highly stressed by P3 when they say, the greatest risk is human beings, meaning that people and their behaviors have a great impact on the result of the project.

"In all kind of projects, you have pretty much the same risks always and the biggest risk are human beings, that the people are always, I think, biggest risk in the project, because you may lose people."

These are risks associated with a lack of expertise, loss of key staff and difficulties in attracting skilled resources in the important project phases. Another significant concern, which arises, is resistance to change, especially in transformation projects where organisational processes and working practices must be changed. P5 is pensive about communication problems by pointing out,

"It's a human factor. For example, training needs vary a lot depending on, you know, the experience of the people, the age of the people and even the culture of the people. It changes the training requirements, and behaviors are very hard to change."

Also, corporate behaviour, like the absence of ownership and coordination gaps, also adds to the exposure of risks. These results indicate that not only are risks technical but also ingrained within the organisational behaviour, and human factors play a significant role in the creation of project-level risk.

4.6.3 Resource and Constraint-Based Risks

Limitations in budget, time and organisational capacity are closely associated with resource and constraint-based risks that have a direct impact on project execution. The financial constraints are also a common problem, as P4 points out that money is never enough, meaning that the budget constraints inhibit the capacity to employ risk mitigation measures fully.

"Money is always scarce, as we can say. And then another major driver is constant change."

This can cause challenges in prioritisation, whereby some risks are not fully addressed because of a lack of resources. Time pressure also adds pressure to the project, especially in a high-paced transformation environment. P5 adds

"We don't have. Time dedicated to the implementation. And I know I work in a large organization that is much more established and has more resources available compared to what we have now."

Besides this, there are issues related to capacity, such as a lack of skilled staff, leading to further problems when dealing with project teams. These constraints decrease the flexibility in decision-making and predispose higher chances of compromised results, proving that resource constraints are a powerful factor of project-level risk.

4.6.4 Temporal Nature of Risk

The results suggest that risks at the project level vary at various phases of the project lifecycle but do not stay the same. During the initial stages, risk identification plays an important role, and the risk identification is performed at the very start of the project. Nevertheless, participants underline that not every risk is apparent in the preliminary planning. Many risks are identified during testing and integration phases whereby system behaviour is tested. P6 emphasizes that these phases tend to expose performance problems and unforeseen system behavior, which means that testing serves as a crucial milestone of revealing the concealed risks. Risk is also said to be continuous beyond certain phases. P2 describes risk management as an ongoing process, that there will be something new behind the next corner, as the project environments are dynamic.

Moreover, not all risks are noticed during the implementation of projects. P4 refers to the challenges post-implementation and especially to the areas of adoption and system usage.

“Risk management needs to be continuous. Because when the project is moving onwards.”

This shows that risk is not limited to completion of the project, but one has to monitor and adapt to the project lifecycle.

4.7 Theme 3: Project Risk Management Practices

4.7.1 Formal Risk Management Approaches

Formal risk management is more pronounced in the larger organisational settings which have structured frameworks that are used to evaluate and prioritise risks. Participants

also point out systematic tools like probability-impact matrices and risk scoring mechanisms to assess the risks. We provide scores, according to probability and impact, according to P3, which implies a quantitative method of prioritisation.

"We have our own internal risk assessment method, where we give scores to the risks based on their probability and the impact. And then we have the score for the risk, and then for those where we have the high, for example, high impact and medium probability, then we have a kind of a closer, you could say, closer follow-up plan for all of them. And of course, they are also prioritized higher than the others."

It is an organized evaluation of risks that are measured and recorded. These methods offer some standardisation and transparency, but implementation of these methods differs among organisations, implying that formal frameworks are rather guiding instruments than entirely defining the practice of risk management.

4.7.1.1 Informal and Adaptive Practices

Unlike formal approaches, a number of participants report application of the informal and adaptive strategies especially in smaller or less structured settings. Experience, judgement and continuous communication are important in risk management in such settings. P5 emphasizes this as it says,

"So when we implement something and if something doesn't work, if it has multiple problems, we just, you know, these are just almost like weekly meeting subjects that we manage. We don't have a sophisticated way of prioritizing them and tracking them."

Making decisions tends to be based on past experience and situational awareness, and flexibilities in responding to new problems. The practices show that adaptability is an important aspect of risk management, and matters more in a dynamic environment when formal processes might be inadequate in capturing changing issues.

4.7.2 Continuous Risk Monitoring

Risk monitoring is not a one-time endeavor, but a continuous and repetitive process. Participants emphasise the importance of regularly reviewing and updating risk assessments as projects progress. P2 also observes that risk management is a continuous follow-up, which implies that risks are revisited and re-assessed as the project lifecycle progresses. This progressive mechanism enables project teams to react to arising problems and modify mitigation plans based on this response. Constant observation will make sure that the risk is visible and manageable, especially in a complex setting where things keep on changing very quickly. It is a move towards non-static planning and continuous assessment and responsiveness.

4.7.3 Risk Mitigation Strategies

Risk mitigation strategies are more concerned with practical and operational actions that are geared towards minimizing the probability or effect of the realized risks. One of the solutions appears to be testing; P1 outlines several stages of testing. mitigate the risks before continuing, which implies that validation should be applied prior to implementation.

"We actually stop like the Project and focus on the risk management to solve the issues. So, I would say that the multiple phases of testing where the risks are occurring, we mitigate the risks before continuing the project"

Other measures are to divide tasks into small bits that are easy to manage, rollback plans, and inter-team communication. These solutions facilitate the early identification of problems and offer solutions to manage disruptions. The focus on pragmatic solutions implies that mitigation is tightly connected with the implementation of operations as opposed to the use of predetermined plans.

4.7.4 Risk Acceptance

Another practice that is acknowledged by participants is the fact that risks are not all avoidable and risk acceptance becomes a feasible approach. P1 observes that you always live with risks that can be managed, meaning that there are risks that are accepted where mitigation is not possible or reasonable.

"So you need to handle the risk levels, To actually have the best outcome, you always live with Manageable risks to notice and to work on later on, also, but to handle the actual Important ones is maybe the crucial thing."

This is indicative of risk evaluation process in which risks are judged by how much they can affect them, and how much resources they will need to mitigate them. Manageable risks should be accepted by project teams to ensure that they do not overstretch resources. This method emphasizes that risk management is a process of striking a balance between control and realism, and it is important to realise that it is often not possible to totally remove risk in the complex project environment.

4.8 Theme 4: Governance and Risk Control Mechanisms

4.8.1 Risk Escalation Structures

Risk escalation is a process by which the project level risks are reported to the higher levels of management. The participants report that risks are first handled as a project team but became out of control when it was beyond their control. All the high risks are taken to the management, which is a hierarchic flow of information. On the same note, P2 articulates that the escalation normally shifts to senior management or steering groups.

"We are very flat organization. We only have me as the as the head of the organization. Then everybody, everybody reports to me. We don't have different layers. But then, when we are on matters that involve the headquarters, then, of course, we have many more layers. The escalation is from Finland, it happens depending on the project,

depending on the task that we are doing. It would probably usually be escalated through the IT department in our headquarters. But here in Finland, it starts with me. And then I will I will to be directed to IT, IT. That is, we have outsourced. We have like a third party that is doing our IT services. So then they can help."

This stratified structure will guarantee that the critical risks are properly attended to and decision-making authority is granted. It also emphasises the need to have escalation mechanisms to ensure high-impact risks in complex project settings are visible and controlled.

4.8.2 Role of Steering Committees

The steering committees are the key to governance, as they are involved in the decision-making of major risks of the project. Respondents refer to these committees as the ones that assess risks, resource allocation and mitigation strategy. P4 observes that they take decisions. According to the presentation made by the project manager, project-level knowledge is used to make decisions.

"Because sometimes, it's difficult that your top management tells you that this project is very important and it has to succeed. And then at the same time, they make decisions which jeopardizes the project, for example, cutting down the number of the people in the company. You know that at the moment, especially it's happening all over Finland that the number of the people in companies are being reduced."

In the same vein, P2 emphasizes that steering groups are supportive when there are critical matters at hand. These committees will not directly deal with risks; they are just oversight processes, which ensure that project activities are aligned with the organisational goals. They are especially essential in complicated projects when decisions on a high level are needed.

4.8.3 Governance Challenges

Although mechanisms of governance exist, participants report some challenges that influence their effectiveness. Slow decision-making is one of the key problems, especially when dealing with large organisations with complicated hierarchies. P3 mentions that decision-making is not always quite effective in large companies, pointing to delays in responding to critical risks.

"I would say that usually in any company, not just at the company where I work now, but everywhere where I have worked, the higher you have to go, the more difficult it gets from that point of view that they are so far from the actual work that they need more like analysis and explanations and kind of pre-decisions and things like that. So, decision-making is not always very effective in big companies."

Another challenge is misalignment of stakeholders, where the different stakeholders may have conflicting priorities and viewpoints, and thus may not make effective decisions. P4 also cites instances where the absence of alignment in steering groups poses challenges in executing projects. These issues suggest that governance structures, as needed, may also create inefficiencies that may affect timely risk management.

4.8.4 Risk Propagation Across Systems

The propagation of risks turns out to be a major issue as the telecom systems are interdependent. The participants emphasize that risks that arise in one component may be transferred to various systems and projects. P1 observes that, several projects. Risk levels are on the rise, and this implies that parallel project setups expose project participants to interrelated risks.

"So If you're leading if you're leading multiple projects, then then we usually know that Some of them gets more focused than the other ones So it's maybe to handle the level of transformations we are doing uh to actually have the best expertise in the transformation projects because the risk levels are getting higher if you have like Several projects running in parallel Uh, you don't have the same level of expertise in every project"

Furthermore, reliance on third-party tools, which represents the impact of third-party vendors on the project performance. These interdependences form an interrelationship of risks that goes beyond projects. Consequently, risk management should not just look at individual problems but also consider the wider system context within which projects are being undertaken.

4.9 Summary of Chapter

The empirical evidence on the project-level risk management in digital transformation projects in telecom was presented in this chapter. These findings suggest that structural complexity due to integration of multi-systems and legacy environments is a strong factor of risk. One of the patterns is the strength of human and organisational variables, which emphasise the uncertainty, which is associated with behaviour, skills, and coordination. The practice of risk management is demonstrated to be dynamic and iterative and involves a combination of formal and experience-based methods and ongoing observation. Also, the governance structures act as control mechanisms in terms of escalation and decision making, but the effectiveness of these mechanisms varies in diverse organisational environments. In general, the results indicate a multi-dimensional and dynamic risk environment.

5 Chapter 5: Discussion

5.1 Introduction

This chapter is an interpretation and critical analysis of the empirical evidence found in Chapter 4 in the light of the theoretical frames that have been developed in Chapter 2. The discussion is organised based on the main themes detected with the help of the thematic analysis, incorporating the knowledge of the digital transformation complexity, the project risk management (PRM), and the governance in the complex project systems. This chapter aims to evaluate the understanding and management of project-level risks in large-scale telecom digital transformation projects and to determine the level of agreement, extension, or disagreement with current literature. This discussion directly answers the research question and objectives by exploring the sources of risk, risk management practices and efficiency of risk governance in the Finnish telecom environment.

5.2 Digital Transformation Complexity as the Structural Driver of Risk

The results are very strong that the complexity of digital transformation is a structural generator of project-level risk, but not a contextual factor. This is in line with Vial (2019), who theorises digital transformation as a socio-technical reconfiguration, which impacts technological as well as organisational systems. The empirical data proves that transformation entails system integration of large scale, coexistence of legacy and interdependent that is very high and adds a lot of uncertainty. This is in line with the normal accident theory by Perrow (1984), which argues that closely coupled systems are always vulnerable to failure. These results show that telecom environments are characterized exactly by these features whereby interdependence in the system generates cascading failures. The existence of legacy systems also justifies Sebastian et al. (2017) who believe that legacy-modern integration causes more uncertainty in the migration phases.

Nevertheless, the results expand the current body of literature by noting that complexity is not just technical but also organisational and contractual. Although Chapter 2 also

recognizes the existence of socio-technical complexity, the empirical evidence demonstrates that the issues of contractual diversity and stakeholder alignment contribute highly to the exposure to risks. This implies that telecom transformation is multi-layered and it is a complex combination of infrastructure, organisational processes and external dependencies. Moreover, the results also support Elliott and Stead (2017) who believe that digital transformation brings about emergent uncertainty. The respondents always state that risks are not always predictable, which substantiates the claim that the risk is inherent in the transformation processes and is not imposed on them. This is a criticism of deterministic conceptions of risk and provides for a complex systems approach, in which uncertainty is dynamic and pervasive.

5.3 Nature of Project-Level Risk: From Event-Based to Systemic and Emergent

The empirical evidence shows that project-level risks are multi-dimensional and dynamic, which is in line with and extends literature on the risks of digital transformation. The main risk attributes determined in Chapter 2 include technical debt, regulatory risk, and cascading failures (Vriezekolk, 2016; Buldyrev et al., 2010). These risks are confirmed by the findings but human and organisational factors are shown to be as significant (or more so). This contradicts the traditional PRM assumptions, which theorise risk as one-off, identifiable events (PMI, 2021; ISO, 2018). Rather, the results indicate that risks arise due to systems interactions, inter-person interactions, and organisational constraints. Human aspects such as skill deficiencies, resistance, and communication problems are always mentioned as the prevailing sources of risk. This is consistent with Kessler et al. (2023), who state that uncertainty in digital projects changes the risk management to be reactive process instead of proactive.

Moreover, the results confirm Maylor et al. (2008) who emphasize that interdependent systems create relational and systemic risks but not isolated events. Risks are not limited to technical failures but spans across organisational borders as the telecom transformation is interconnected. This shift is further supported by the temporal aspect of risk.

Although PRM presupposes that the risks can be recognized in the early stage, the results indicate that risks change during the project lifecycle, especially during the testing and post-implementation phases. This confirms Elliott and Stead (2017), who believe that the risks of digital transformations can be comprehended in full only retrospectively. Generally the results suggest that there is a shift of event-based risk to systemic and emergent risk, with uncertainty being a continuous process that is influenced by dynamic project environments.

5.4 Project Risk Management Practices: From Predictive Control to Adaptive Capability

The results indicate that there is a serious discrepancy between formal PRM models and real practice, which confirm the criticisms made in Chapter 2. Conventional PRM models (PMI, 2021; ISO, 2018) presuppose that risks can be defined, analysed, and managed in a systematic manner, using systemised procedures. Although these tools exist in practice, they are weak in the digital environment that is complex. The results validate the use of formal tools, like probability-impact matrices and risk scoring, especially in larger organisations. These tools however do not adequately reflect the dynamic aspect of risk. This is in line with Flyvbjerg (2014), who contends that formal planning always gives a false sense of control, especially in a complex project.

Rather, risk management is demonstrated to be an iterative and adaptive process, which is consistent with Hillson and Murray-Webster (2017), who suggest resilience-based practices. The introduction of continuous monitoring, repeated evaluation and mitigation through testing becomes a predominant trend, as an indicator of the transition between predictive control and continuous learning. This change is further emphasized by the existence of informal practices. Smaller organisations have experience-based decisions and frequent discussions as their risk management frameworks. This implies that flexibility and responsiveness are important skills that are essential in dealing with uncertainties. the results also emphasize risk acceptance as an important practice. This contradicts past PRM assumptions that risk must be eradicated, but rather risk

management involves trade-offs and prioritisation. This is in line with the modern views which stress the role of dealing with uncertainty and not eradicating it. Comprehensively, the results indicate that adaptive capability, a combination of formal tools and experiential knowledge and continuous learning is needed in risk management of telecom digital transformation.

5.5 Governance as a Mediating Mechanism in Risk Management

The results affirm that governance is critical in the organization of risk management in alignment with the theoretical arguments referred to in Chapter 2. Governance systems such as steering committees and escalation structures are formal decision-making and risk management processes (Muller et al., 2016). High-impact risk processes are managed at the right level of the organisation, which is why risk escalation processes are deemed important because they emphasise the need to have structured escalation to improve transparency (Glaser and Risius 2016). The presence of steering committees is an additional sign that Kiral (2025) is right, and clear decision rights are important in complex projects.

Nonetheless, the results also indicate weaknesses in the effectiveness of governance. Slowness in decision making and lack of coordination among stakeholders are an oft-repeated occurrence, especially in big organisations. This is in line with Jiang (2023) who argues that the structures of governance are prone to inefficiencies in as far as the mechanisms of coordination are not well aligned. The results also prove the significance of portfolio-level coordination since there are several projects running concurrently as part of telecom transformation programmes. This is in line with Jöhnk et al. (2020) who mention the complexity of interdependent project systems.

Also, the results complement the literature in the field of governance by highlighting the importance of vendor dependencies in the spread of risks. This aligns with Tannir et al. (2023), who state that inter-organisational relationships enhance coordination complexity and expose the risk. Altogether, the governance is demonstrated as a mediating

process, which coordinates and balances control. Nevertheless, the success depends on the organisational structure, decision-making effectiveness, and inter-stakeholder alignment.

5.6 Integration of Findings with Research Objectives

The results give a well-rounded answer to the research objectives by helping to show how risk management at the project level functions in the complicated telecoms-digital transformation settings. To begin with, the study finds that risks are multi-dimensional; they can be technical, human, organisational, and resource-based, thus confirming the fact that risk is not an isolated phenomenon but embedded in project systems structurally. Second, risk assessment practices have been demonstrated to incorporate both formal, i.e. the use of structured assessment methods, and informal as well as experience-based assessment, facilitated by continuous monitoring as opposed to the use of a fixed assessment. Third, the competence of project risk management (PRM) and governance mechanisms is critically appraised and it has been found that PRM practices are both adaptive and iterative but limited in their ability to deal with system complexity whilst governance structures offer the control needed but also introduce delays and misalignment. Lastly, the findings form a solid base on the formulation of effective, project management oriented recommendations to enhance risk mitigation of any future digital transformation projects.

5.7 Conclusion

This chapter has shown that the structural complexity, emergent uncertainty, adaptive practices, and governance mechanisms are the factors that essentially define project-level risk management in telecom digital transformation. The results affirm that conventional predictive models cannot be used in complex environments and that they need to shift to dynamic and context-sensitive models. These lessons can be of great help in formulating practical recommendations in the following chapter.

6 Chapter 6: Conclusion and Recommendations

6.1 Conclusion

This study aimed to investigate the management of project-level risks in large-scale digital transformation projects in large Finnish telecom providers. The main question that guided the research was: How are project-level risks in large-scale digital transformation projects at major Finnish telecom operators managed? Four main objectives that included risk identification, risk assessment, risk management practices, and risk governance effectiveness supported the research.

The results indicate that the structural complexity inherent in the telecom digital transformation project's project-level risk is determined by the structural complexity arising from multi-system integration, legacy infrastructure, and socio-technical interdependencies. Risks are not outside factors and are part of the transformation project's architecture. This directly responds to the Objective (a), which ascertains that risks are multi-dimensional and comprise technical, human, organisational and resource-based factors. The co-existence of old and new systems, alongside real-time operation’s needs, makes the context constantly in a state of instability, with uncertainty being the rule and not the exception.

One of the main conclusions of the findings is that human and organisational factors are the greatest source of risk and they often override purely technical challenges. Skill, communication, change resistance, and stakeholder alignment risks are always found among the participants. The fact that it has made a move to change the perception of project risk to a socio-organisational phenomenon is especially significant. Although the extant literature recognizes the existence of socio-technical complexity, this paper shows that human forces have a prevailing influence on the determination of project outcomes in telecom transformation settings.

Regarding Objective (b), the study concludes that the risk assessment practices are hybrid in nature, as they are both formal and informal with experience based practice.

Organised tools, e.g. risk scoring and probability-impact matrices, are employed (especially in bigger organisations). Nevertheless, these tools cannot be adequate in terms of dynamic and emergent nature of risks. On the other hand, constant surveillance, repetitive re-evaluation and informal communication systems play a critical role in dealing with uncertainty. This means that the traditionally fixed, predictive risk evaluation has been turned to a more responsive and dynamic one.

In reference to Objective (c), the activity of project risk management (PRM) practices and governance mechanisms is known to be situational, and to some extent, limited by complexity. PRM practices are dynamic and evolving, allowing organisations to react to new risks, but it cannot fully predict uncertainty. The governance bodies such as the escalation mechanisms and steering committees give requisite control and decision making powers. However, not only in large organisations but generally, governance effectiveness is compromised by slowness in decision making, lack of coherence between the stakeholders and structural inflexibility. This implies that governance can act as an enabler and a constraint to risk management at the project level.

The other important conclusion made is that risk is temporal and constantly changing throughout the project lifecycle. risks are experienced in various phases such as early planning, testing, and post implementation phases. This supports the claim that risk cannot be completely defined initially and must be managed constantly. What this means is that project level risk management should be modeled as an ongoing process as opposed to a one-off activity.

In general, the study provides an answer to the research question by showing that project-level risk management in the telecom digital transformation is defined by adaptive practices that are driven by structurally complex and uncertain environments and facilitated by the governance mechanisms, though not entirely governed. Risk management is not hence about risks avoidance but rather about negotiating the risks via a blend of formalised tools, experience and organisational co-ordination.

6.2 Recommendations

According to the conclusions made, some practical recommendations are provided to enhance the project-level risk management in telecom digital transformation initiatives. These suggestions are directly based on the empirical results and are in line with the research objectives.

6.2.1 Strengthening Adaptive Risk Management Practices

Since risk is emergent and constantly changing (Section 4.5.2), organisations ought to abandon the traditional risk management models and embrace dynamic risk management models. This involves the installation of real-time risk monitoring systems, repetitive risk approval process, and mitigation strategies which are flexible. Continuous learning mechanisms should be given a priority in organisations in which risk insights are constantly incorporated and up-to-date into project decision making (Meyer & Reniers, 2025). This recommendation helps to fix the drawbacks of the conventional PRM models discovered in the findings.

6.2.2 Enhancing Human-Centric Risk Management

Since the human and organisational factors are determined as the most influential sources of risk (Section 4.5.2.2), the organisations must invest in capabilities building, stakeholder alignment and change management practices. This involves specific training programmes, enhanced communication structures and formal stakeholder engagement procedures. Also, organisations should aim at retaining critical talent and continuity of knowledge in projects (Sanz & Hovell, 2021). Human factor will be addressed and this will greatly minimise uncertainty and enhance the project outcomes.

6.2.3 Integrating Formal and Informal Risk Management Approaches

The results indicate the overlaps between formal and informal practices (Section 4.5.3). Organisations ought to establish integrated risk management systems which involve the combination of structured tools and the experiential decision-making. Formal structures

must be changed to be flexible to enable the teams to react to arising risks. Institutionalisation of team discussions and feedback loops and knowledge sharing practices should be accompanied by formal procedures to promote responsiveness (Hristov et al., 2022).

6.2.4 Improving Governance Efficiency and Decision-Making

Inefficiencies noted in Section 4.5.4 should be dealt with by redesigning governance mechanisms. Organisations are advised to work on decision-making processes, roles and responsibilities and enhancement of the escalation routes. Cutting down on bureaucratic delays and increasing alignment among stakeholders will make the governance structures more effective. Moreover, the decentralisation of some decision-making powers can allow responding more quickly to the arising risks (Mladenova, 2024).

6.2.5 Managing Interdependencies and Risk Propagation

Since the degree of interdependence of the systems is high (Section 4.5.4.5), organisations ought to use system wide approach to risk management. This involves enhancing interface management, improving coordination of parallel projects, and improving vendor management practices. Organisational mechanisms should also be in place to detect and track cascading risks across systems to make sure that interdependencies are well managed (Li et al., 2025).

6.3 Potential Impact

The implications of this study in terms of findings and recommendations are important to both telecom organisations and the field of project management in general. Operationally, adaptive risk management practices can enhance efficiency of projects, decrease delays and increase reliability of systems. Organisations would be in a position to enhance the alignment of the stake holders as well as minimise implementation issues by managing the human and organisational risks. Financially, the cost increase and project failure can be avoided through better risk management, contributing to a more

effective utilization of resources. Eschewing ill-conceived transformation efforts can lead to huge cost reductions.

Strategically, the study offers a framework of coping with complexity in massive digital transformation projects. These insights enable organisations to increase their ability to transform and remain competitive in the long run. On a more general level, the research also adds to the knowledge base of risk management in the complex project settings, providing knowledge that can be generalized even out of the telecom industry, especially in other infrastructure-reliant industries.

6.4 Limitations

There exist a number of limitations in this study. To begin with, the study is a qualitative study, with a relatively small sample size of the respondents in the Finnish telecommunications industry, which could restrict the extrapolation of the results to other sectors or settings. Second, the availability of confidential project information was limited, which inhibited the possibility to use detailed quantitative risk measures or confirm the results using numerical analysis. Also, the factor of self-reported interview data could create subjectivity and possible bias in the responses of the participants. These are limitations, which imply that the results must be viewed in the context of the particular organisation and industry under study.

6.5 Future Research

Future studies can base their work on this research through a mixed-methodology that incorporates the quantitative data with qualitative information to increase the analytical strength. It would be helpful to expand the scope and consider various industries or geographical areas in order to make comparative analysis and enhance generalisability. It is also possible that future research will consider project-level risk management in different organisation sizes and maturity. Also, the potential to investigate how emerging technologies could be used to enhance the process of risk identification, monitoring, and mitigation is substantial, including artificial intelligence and data analytics. This research

would help in coming up with more sophisticated and evidence-based risk management models.

6.6 Final Conclusion

Finally, this study has shown that complexity, uncertainty, and interdependence are the core elements of project-level risk management in the telecom digital transformation. Conventional predictive measures are not enough to deal with these challenges and have to shift to adaptive, integrated, and human-centered risk management practices. Governance mechanisms are very important but they should be optimised in order to enhance efficiency and alignment. The research has both theoretical and practical implications, as it has presented an in-depth insight into the management of risks in a complex transformation environment and has provided the basis to enhance the practice in future projects.

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Appendix 1: Semi-Structured Interview Questionnaire

Study Title: Project Risk Management in Large-Scale Digital Transformation Projects within Major Finnish Telecom Operators

Introductory Statement

Thank you for agreeing to participate in this research interview. The purpose of this study is to examine how project-level risks are identified, managed, and governed in large-scale digital transformation projects within telecom organisations. Your professional experience in digital transformation or project management provides valuable insights into how risks emerge and are addressed in practice. The interview will focus on your experiences with project risk management, governance mechanisms, and challenges associated with telecom digital transformation initiatives. The interview is expected to last approximately 30–45 minutes. All responses will remain confidential and will be used only for academic research purposes. Participation is voluntary, and you may choose not to answer any question or withdraw from the interview at any time.

Section 1: Professional Context

1. Could you briefly describe your current role and your involvement in digital transformation projects within your organisation?
2. Based on your experience, how would you characterise the complexity of digital transformation projects in the telecom sector?

Section 2: Risk Emergence in Digital Transformation Projects

3. What types of project-level risks commonly arise during large-scale digital transformation initiatives in telecom organisations?
4. At what stages of the project lifecycle do these risks typically emerge, and why?
5. In your view, what factors contribute most significantly to risk generation in telecom digital transformation projects?

Section 3: Risk Identification and Assessment

6. How are potential risks usually identified at the beginning of digital transformation projects?
7. What processes or tools are used to assess and prioritise project-level risks during project execution?
8. To what extent are formal risk management frameworks used in your organisation?

Section 4: Risk Mitigation and Management Practices

9. How are risk mitigation strategies developed and implemented during digital transformation projects?
10. Can you describe any practices or mechanisms that have been particularly effective in managing project risks?
11. What challenges do project teams face when attempting to mitigate risks during project execution?

Section 5: Governance and Decision-Making

12. How are risks escalated within project governance structures when significant issues arise?
13. What role do steering committees, programme governance bodies, or senior management play in risk management?
14. In your experience, how effective are governance mechanisms in addressing project-level risks?

Section 6: Lessons and Future Improvements

15. Based on your experience, what improvements would you recommend for managing risks more effectively in future telecom digital transformation projects?

Closing Statement

Thank you very much for sharing your insights and professional experience. Your responses will contribute to a better understanding of project-level risk management practices in telecom digital transformation projects. If you are interested, a summary of the research findings can be shared with you once the study is completed. Please feel free to contact me if you have any additional comments or questions regarding this research.

Appendix 2: Participant Information and Coding Structure

To ensure confidentiality and ethical compliance, all interview participants were anonymised using coded identifiers (P1–P6). The table below provides a general description of participant roles and organisational context without revealing identifiable information.

Table 2: Participant Information and Coding Structure

Code	Role	Organisation	Area of Involvement	Interview Date & Time	Duration
P1	Project Manager	Finnish Telecom Operator	Digital transformation and project execution	19.03.2026, 09:03–09:25	19m 52s
P2	Project Manager	Finnish Telecom Operator	Project-level risk management and implementation	23.03.2026, 09:02–09:43	38m 56s
P3	Senior Project Manager	Finnish Telecom Operator	Governance, risk management, and transformation projects	24.03.2026, 17:01–17:35	32m 24s
P4	Telecom Professional	Finnish Telecom Operator	Digital transformation and operational processes	27.03.2026, 08:02–08:30	26m 57s

P5	Managing Director	Telecom Hardware Provider	Strategic leadership and project delivery	25.03.2026, 13:29–14:04	43m 33s
P6	Senior Developer (Marketing Automation)	Finnish Telecom Operator	System integration, automation, and data platforms	24.03.2026, 17:50–18:08	17m 52s