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Strategic Risk Management Practices in Nepalese Road Infrastructure Projects:

A Qualitative Interview-Based Study

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ABSTRACT

Developing the infrastructure especially road sector is an essential part of economic and social development of developing countries such as Nepal. But, there are many problems associated with the planning phase of the road infrastructure projects in Nepal and many of the projects become delayed and over budget. This is a qualitative study to understand the practices of strategic risk management in the planning phase of road infrastructure projects in Nepal, highlighting the difference between international standards (ISO 31000:2018) and the PMBOK Guide and practical implementation in the context of Nepal where it is based on a resource-constrained and topographically challenging, multi-level federal governance system.

The study is based on the interpretivist paradigm, and semi-structured interviews with twelve professionals from the Department of Roads, local governments, consultancies, contractors and academia. Thematic analysis was used to analyse the data, based on Braun and Clarke's six-phase model, with the use of NVivo software. Patterns in the lived experiences of the participants in identifying, analysing, evaluating, mitigating risks and experiencing the overall effectiveness were identified with this method.

Results show that the road sector, in general, has limited formal, experience-based and proactive risk management activities in Nepal. The top 7 risk categories that are highly interdependent and dominate the planning phase include geotechnical/topographical risks, land acquisition/social risks, budgetary/financial risks, environmental/regulatory risks, political/governance risks, coordination/stakeholder risks, and design/data/feasibility risks. The approach of risk identification is largely based on field surveys and expert judgement; analysis and evaluation are largely qualitative with little application of formal tools or quantitative analysis. Mitigation strategies are mostly reactive, and involve a mix of engineering solutions and stakeholder engagement. There are governance and co-ordination problems related to institutional fragmentation and political influences that limit effective risk management. In general, the current practices are viewed as marginally effective for handling immediate risks, and insufficient for strategic long-term risk management. The study validates the conceptual constructs which connect formal standards, institutional context and professional practice. It highlights the importance of formalising risk management mechanisms, improving data quality and feasibility studies, improving inter-agency coordination and developing professional and technological capabilities. The recommendations are aimed at complementing international good practices and the reality on the ground, and hence to help achieve more resilient and efficient road infrastructure development in Nepal.

Keywords: Risk management, road infrastructure, planning phase, Nepal, ISO 31000, PMBOK, qualitative study

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CHAPTER 1: INTRODUCTION

1.1 Background of the Study

Infrastructure development is a key pillar of economic development and social development in developing countries. Roads, in particular, serve as the arteries of national economies and enable the transport of goods, services and people, and play a crucial role in providing access to markets, education, healthcare and government services (Asian Development Bank, 2025). Road connections are even more critical in Nepal, a landlocked country with extreme topographic variation from the flat plains of the Terai to the rugged mountains of the Himalayas. Because of the difficult terrain alternative modes of transport are not feasible and roads remain the main source of economic activity, regional integration and social cohesion (Koirala, 2017; Government of Nepal, 2024).

But the relationship between infrastructure investment and development outcomes is not intended. Infrastructure initiatives are more likely to be successful when they are resilient in low- and middle-income countries, where their success may be compromised by environmental risks, impacts of climate change, and weak governance. In the case of Nepal, this is especially true for its road projects, which are often plagued by significant implementation problems, such as delays, overspending, and coordination issues. Thus, risk management is a key part of successful project management. International standards like ISO 31000:2018 lay down principles and guidelines for embedding risk management in organisational processes and decision-making (International Organization for Standardization, 2018), and the PMBOK Guide also gives importance to the proactive nature of risk management throughout the project lifecycle, especially to the early stage of planning (Project Management Institute, 2017, 2021).

While such frameworks exist, there is limited understanding of how these can be translated into practice, particularly in developing country settings where the landscape is complex and there are multi-level governance structures. This research is about Strategic Risk Management in the planning stage of road infrastructure projects in Nepal as seen by project professionals.

1.2 Problem Statement and Research Gaps.

Nepal has been notorious for the delays and over-budget of the road infrastructure sector. These problems have been constantly reported by the Department of Roads in their annual reports in many projects (Government of Nepal, 2024). A notable case is the Narayanghat-Butwal Road Expansion Project which was awarded the contract in December 2018 with a scheduled completion period of 42 months. Progress on the physical works is about 74% as of end 2025, while the technically challenging Daunne stretch is only around 50% complete with several extensions of deadlines (Sharma, 2025).

The reason for these delays are due to the complexities of the governance process such as delayed handover of sites, delayed environmental clearances and tree cutting, relocation of utilities, and limits placed on material extraction by local government. These issues reflect on the lack of coordination between the Department of Roads, local government and contractors as well as poor systems of accountability, (Koirala, 2017). Elsewhere in the world, researchers have pointed to the strategic misrepresentation and optimism bias in the planning and approval phases of megaprojects for their performance failures (Flyvbjerg, 2009; Lovallo & Kahneman, 2003; Lovallo et al., 2023). Optimism bias results in underestimated costs and risks, and strategic misrepresentation is the intentional misrepresentation of information for project approval.

These are further complicated in developing country settings by limited institutional capacity, regulatory volatility and the inability of multiple agencies to coordinate effectively (Mazher et al., 2022; World Bank, 2019). There is extensive understanding of these systemic issues, but less empirical study of the way in which risk management is being done in the planning phase of road projects in Nepal. There is a lack of research on the gap between international standards (ISO 31000:2018 and PMBOK Guide) and their implementation in the local context, especially in the context of limited resources and federal governance structure in Nepal. To fill these voids, this study examines

strategic risk management practices during the planning stage of road construction projects in Nepal as experienced by the professionals in the profession.

1.3 Research Questions

The study is directed by one central question and three supportive ones:

Main Question:

Which are the most common risks in the planning stage of road infrastructure projects in Nepal and how are these risks identified and mitigated by the project professionals?

Supporting Questions:

1. What are some of the most common risks encountered during the planning stage of road projects?
2. What is the mechanism of identifying these risks at the planning stage?
3. How are these risks analysed and mitigated?

1.4 Research Objectives

1. To determine the major threat during the planning phase by interviewing the project professionals undertaking the Nepalese road infrastructure projects.
2. To review the practices of risk identification and mitigation in practice.
3. To compare identified practices against a set of risk management models (ISO 31000:2018 and PMBOK Guide).
4. To prepare suggestions on how to enhance strategic risk management within the Nepalese road sector.

1.5 Scope and Delimitations

This paper concentrates on planning road infrastructure projects in Nepal, which involves the process of project conception to the feasibility study, detailed design and pre-construction approvals. The study analyzes risk management practices as seen and implemented by professionals in major stakeholder organisations such as the Department of Roads, Road Board Nepal, Project Implementation Units, and consultancy firms dealing with planning and feasibility studies. The research is restricted

to road projects in the public sector leaving out the private infrastructure projects and other forms of transportation. Its geographic focus is Nepal, and its results may be applicable to such situations but cannot be directly applied to other nations or industries. The study uses qualitative research, which focuses more on understanding than statistical generalisability.

1.6 Structure of the Thesis

The thesis is organized in five chapters which systematically discuss the issues of strategic risk management in the planning phase of road infrastructure projects in Nepal. The background of the study and the importance of road infrastructure in the economic and social development of Nepal is provided in Chapter 1. It presents the problem statement and identifies key research gaps (limited empirical knowledge of use of international standards, like ISO 31000:2018 and the PMBOK Guide in practice) and presents the main research question and supporting research questions. The chapter also provides the research goals, scope and limitations and an overview of the thesis structure.

The theoretical and contextual framework is provided in detailed literature review found in chapter 2. It starts with conceptualizing the risk in projects and then takes a look at the existing risk management frameworks, such as ISO 31000:2018 and the PMBOK Guide. Later chapters examine the megaproject paradox, optimism bias and strategic misrepresentation, the importance of the planning stage as a risk source and the unique institutional, political and multi-agency issues of infrastructure projects in developing countries. It then places these issues in the context of Nepal's road sector, summarises the literature, pinpoints research gaps and proposes the conceptual framework connecting formal standards, institutional context and professional practice.

The research methodology is explained in Chapter 3, where it is argued that a qualitative and interpretivist approach was appropriate. It reports on the use of semi-structured interviews, involving 12 professionals, purposefully selected from federal and local government agencies, consultancies, contractors and academia. The chapter provides

information on the research process, data collection and analysis (thematic analysis with NVivo), sampling, trustworthiness and ethical issues.

The empirical results are presented in a thematic way in chapter 4. It identifies the seven most common interdependent risks experienced in planning, reviews existing practice on risk identification, analysis and evaluation, risk mitigation, governance and coordination challenges, and an assessment of the effectiveness of existing approaches, and participants' practical recommendations.

Lastly, Chapter 5 provides a discussion and interpretation of results in the context of literature and conceptual framework. It compares the findings with international standards and established theories, gives deeper insights of the strategic risk management practices in Nepal, gives context specific strategies for improvement, and gives the limitations and direction for future research of the study. This logical sequence provides a coherent path from the problem statement to the empirical study to the recommendations for action.

CHAPTER 2: LITERATURE REVIEW

2.1 Background

In the context of large-scale infrastructure projects, risk management is now a key component of project management. For projects to be successful in developing countries such as Nepal, where road infrastructure is important for economic development and social integration, but where projects are often delayed, over budget, and poorly implemented, it is crucial to conceptualise and manage risks. Literature consistently points out that inadequate risk handling in the initial planning stages can have major repercussions in the subsequent stages of the project, such as budget overruns and project delays (Koirala, 2017; Korytárová & Hromádka, 2020). This section covers the basics of risk in projects, starting with its definition and nature, and then reviewing the most common type of risks that occur in infrastructure projects.

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2.1.1 Definition and Nature of Risk in Project Management

In project management, the term risk is generally understood to mean an event or condition that could have a positive or negative impact on the project if it occurs, particularly on project objectives, which can include scope, schedule, cost or quality. This is explicitly stated in the Project Management Body of Knowledge (PMBOK® Guide)

where it differentiates between individual project risks and overall project risk (Project Management Institute, 2017). The difference between individual risks and overall project risk is that individual risks are specific uncertain events while overall project risk is what the uncertain events do to the project. In addition to threats (negative impacts), the PMBOK® Guide also highlights risks as opportunities (positive impacts), which refocus the traditional view of risks as only the downside.

Likewise, according to the International Standard Organisation (ISO) 31000:2018, risk is the effect of uncertainty on the objectives (International Organization for Standardization, 2018). It highlights this wider, principles-based approach to risk, which shows that risk is not just a bad thing, but an integral part of decision-making in a world of uncertainty. Unlike other risk management standards, ISO 31000 does not define risk management as a discrete activity, but as an embedded process within the organisation and emphasizes the need to be contextually aware, engaging stakeholders and making continuous improvements (Vargas & Campos, 2022).

These standards are further developed in the academic literature which reveals the dynamic and contextual nature of risk. Risk is a dynamic element, changing as the project progresses, due to internal and external factors. Chapman and Ward (2003) – cited in many reviews – state that risk is "the combination of the probability of an event and its consequences", and more recent research focuses on the subjective and perceptual aspects of risk. As an example, Korytárová and Hromádka (2020) state that risk assessment in large infrastructure development should involve some specific assumptions and context such as political, economic, environmental and other uncertainties that exist in developing countries.

Threat vs opportunity is the dual character of risk that has become more prominent in the current project management parlance. The legislation and standards of risk management in the early literature were mainly directed to threats, and the focus of current legislation and standards is on the nature of risk management, which should identify and exploit opportunities as well as threats (Project Management Institute, 2017; Rahmana, 2024). However, most infrastructure projects that are built in resource-

constrained areas still focus on threat mitigation because of the high stakes involved (Tserng et al., 2021).

Risk is clearly connected to uncertainty which can be created by lacking of information, complexity and fluctuating project environments. This uncertainty is exacerbated in infrastructure projects by project longevity, the presence of a diverse range of stakeholders, and vulnerabilities to external shocks like climate change, regulatory changes, and political instability (Mazher et al., 2022). The literature also makes a distinction between the known risks (which can be identified and quantified to some extent) and the unknown risks (emergent or “black swan” events) and the unknowable risks (Flyvbjerg et al., 2003). This conceptualisation highlights the importance of proactive risk management and not reactive crisis management.

Research shows that the risk conceptualisation directly affects risk management. In developing country settings, where institutional capacity may be low, risk is often conceptualized in a pragmatic and experience-based way, instead of formal structures (Koirala, 2017). This results in the application of international standards like ISO 31000 and PMBOK being inconstant as mentioned by Vargas and Campos (2022) in their comparative study. Thus, the notion of risk has been transformed from a rather technical perspective to an integrative and comprehensive paradigm that considers behavioral, organizational and contextual aspects.

2.1.2 Types of risks in infrastructure projects

Road development projects, for example, in topographically complex and institutionally fragile regions such as Nepal are vulnerable to a myriad of interrelated risks. There are several generic categories of risk, and these risks can be interdependent and context specific.

Technical and Geotechnical Risk is one of the most often mentioned in the field of road infrastructure. These include landslide, unstable slope, bad soil conditions and design errors, as a result of poor site investigations (Korytárová & Hromádka, 2020; Li et al., 2021). Geotechnical hazard is especially high in Nepal's mountainous landscape because of earthquakes, landslides triggered by monsoons, and the inaccessibility of remote

locations (Singh et al., 2020). Lack of geotechnical information in the planning phase can result in expensive changes to the design in the construction stage, as stated by Tserng et al. (2021).

Financial and Economic Risks are cost overruns, cost underfunding, inflation, currency fluctuations, and failure to establish contingency budgets. Such risks are particularly high in developing countries where budgets are tight, and projects have a big reliance on international donors (Mazher et al., 2022; Magwedere & Marozva, 2023). In particular, financial risk factors mentioned by Koirala (2017) are a major constraint in infrastructure development in Nepal, such as unrealistic cost estimation and delay in releasing funds.

Political, Regulatory, & Governance Risks: There is a risk of policy changes, political interference, environmental clearance delays, and institutional fragmentation. These risks are aggravated by coordination failures between federal, provincial and local governments in multi-level federal systems such as Nepal's (Butchers et al., 2021; Sikhupelo, 2023). Political uncertainty can cause a change in project prioritisation or sudden policy changes that have a direct effect on planning and approval procedures.

Social and Stakeholder Risks include issues around land acquisition disputes, community opposition, resettlement issues and cultural sensitivities. These risks are especially relevant to projects that involve roads that cut through populated and/or agriculturally productive areas (Aryal et al., 2024; Li et al., 2021). Inadequate or late engagement of stakeholders can lead to protests, lawsuits, and project delays.

Climate change has given the Environmental and Climatic Risks more and more attention. These encompass flood risks, erosion, biodiversity impacts and the difficulty to acquire environmental impact assessments (IEE/EIA) (Sharma & Sharma, 2025; Tserng et al., 2021). In Nepal, these risks are compounded by extreme topography and weather conditions associated with the monsoons, and are related to geotechnical and social risks.

Design, Data, and Feasibility Risks are due to inadequate feasibility studies, incorrect data and false assumptions in Detailed Project Reports (DPR). These basic risks can ripple through all other risks (Korytárová & Hromádka, 2020).

Recent systematic reviews have confirmed that risks in infrastructure projects are not disjointed, but they are complex in nature and interlinked (Li et al., 2021; Mazher et al., 2022). For instance, land acquisition delays can be caused by the geotechnical uncertainties, leading to increasing financial and political risk. These risks are exacerbated by multi-agency coordination challenges, lack of historical data, and weak institutional capacity in developing countries (Sikhupelo, 2023).

The conceptualisation of these risk types highlights the need for context-specific approaches. International standards offer generic frameworks and need to be adapted to local context, in Nepal the sector of roads faces challenges of extreme topography and federal governance structure (Koirala, 2017; Singh et al., 2020). This literature sets a solid basis to explore in practice how these risks are identified, analysed and mitigated - the focus of the present study.

2.2 Risk Management Frameworks and Standards

Risk Management Frames are structured approaches that help identify and respond to the uncertainties that may impact project objectives. Two of the most well-known international standards in this field are ISO 31000:2018 and the Project Management Body of Knowledge (PMBOK® Guide) from the Project Management Institute (PMI). Such frameworks are especially pertinent to infrastructure development in developing nations such as Nepal, where the complex and varied nature of the country in terms of topography, institutional structure, and resource availability necessitates flexible, yet systematic approaches to risk management (Mazher et al., 2022). This section presents detailed analysis of each framework, their comparison and the application to planning of road infrastructure.

2.2.1 ISO 31000:2018 – Principles, Framework and Process

International Standard Organization (ISO) 31000:2018, Risk Management — Guidelines, is an international standard that provides principles, framework and process for risk management in any organization irrespective of size, sector and context (International Organization for Standardization [ISO], 2018). It is flexible and can be adapted and

customized – which is good for a variety of settings, including developing countries with different institutional capacities, unlike prescriptive standards.

The ISO 31000:2018 is based on eight fundamental principles that serve as a philosophical framework for good risk management, as shown in Figure 1. These principles highlight the need to embed risk management in the functions of the organization, not as an isolated function. It should be structured and comprehensive and tailored to the particular situation of the organisation; it should involve stakeholders. The principles also emphasize the importance of risk management being dynamic, information-based, human and cultural-sensitive, and constantly evolving (International Organization for Standardization, 2018).

This is because these principles are especially applicable to developing countries such as Nepal, where one-size-fits-all solutions are often not feasible because of the different institutional, topographic and socio-political conditions (Koirala, 2017; Mazher et al., 2022). Principles promote adaptation of the standard by organizations, rather than mechanical application, leading to ownership and practicality in resource-poor settings.

Figure 1. ISO 31000:2018 Eight Core Principles

The risk management process of ISO 31000 is an iterative process that can be summarized by Figure 2. The heart of it is the inter-related procedure of context-setting, risk identification, risk analysis, risk evaluation, risk-treatment, and monitoring and review. There are ongoing communication and consultation with stakeholders and recording/reporting processes around these activities. This circular approach emphasizes how risk management is iterative and continuous, ever-changing as the project advances and new information becomes available (Tserng et al., 2021).

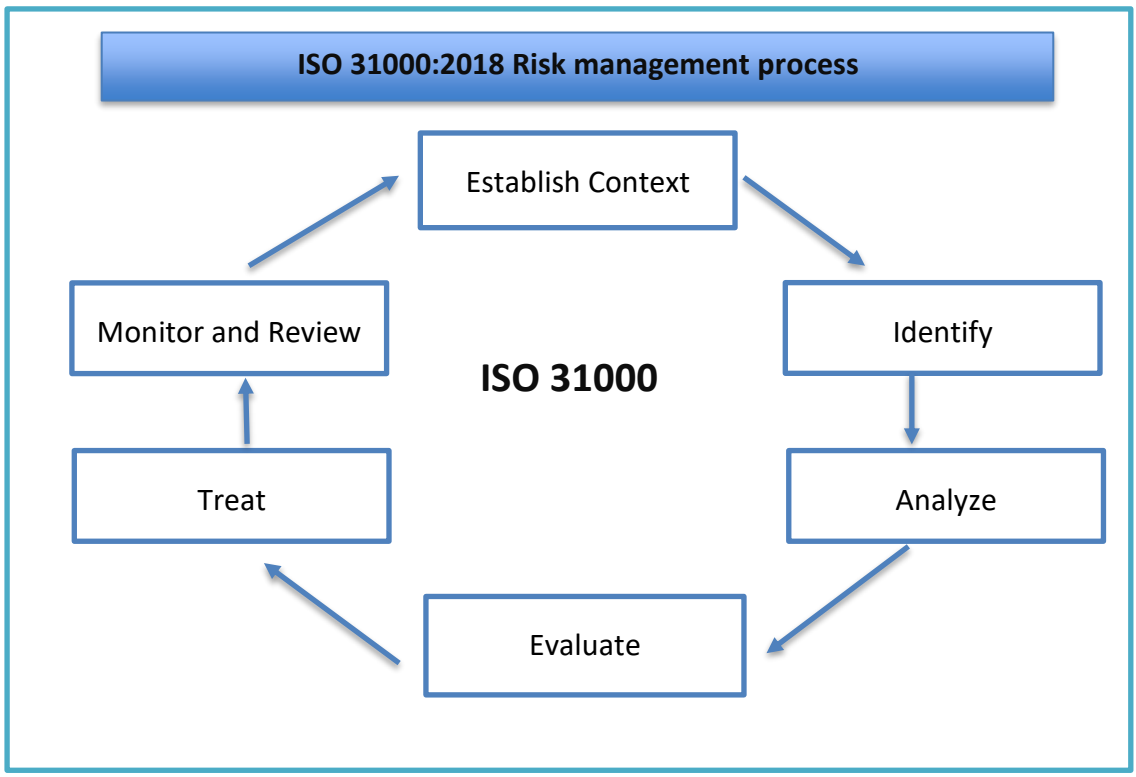

Figure 2. ISO 31000:2018 risk management process (adapted from ISO, 2018).

The iterative loop is particularly meaningful for Nepal's road infrastructure projects, where the uncertainties of landslides, delays in land acquisition, and political shifts are interdependent and unpredictable. The communication and consultation are clearly shown as the “glue” that holds the whole process responsive and context aware throughout the project lifecycle.

2.2.2 PMBOK Guide – Project Risk Management Processes

The Project Management Institute (PMI) has produced a more project-specific and process-based approach to risk management in the PMBOK® Guide (7th Edition, 2017, 2021; the core processes are the same in the 6th and 7th Editions). It is widely used in the project environment, especially in the infrastructure and construction industry.

The PMBOK Guide (6th Edition) defines the systematic processes of project risk management as outlined in Figure 3. These processes are in logical order - Plan Risk Management, Identify Risks, Perform Qualitative Risk Analysis, Perform Quantitative Risk Analysis, Plan Risk Responses, Implement Risk Responses, and Monitor Risks (Project Management Institute, 2017).

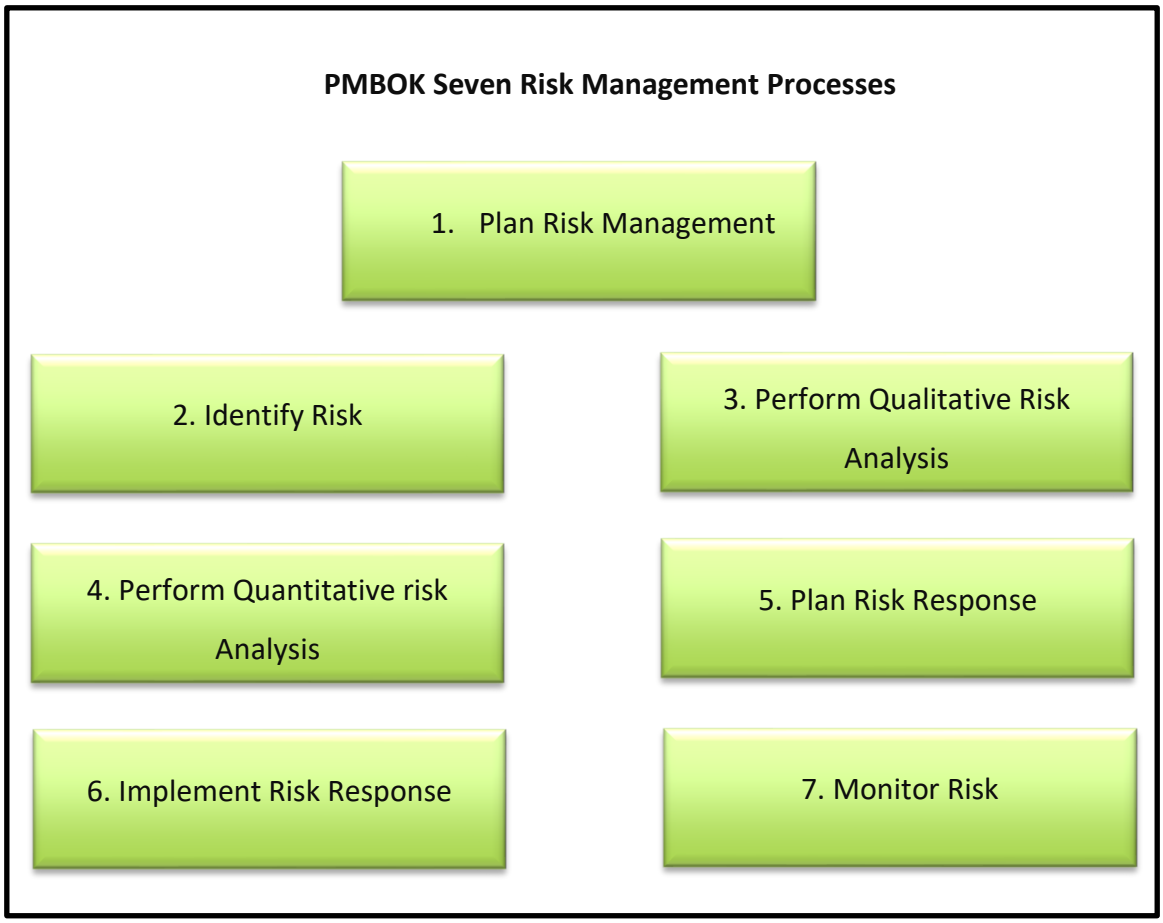

Figure 3. PMBOK Seven Risk Management Processes

The PMBOK processes are more project specific than the general organizational level of ISO 31000. The figure depicts a logical sequence of planning and identification, detailed

analysis, response planning, implementation, and ongoing monitoring. It is structured in such a way that it gives project managers practical tools to implement, such as a risk register, probability-impact matrix, and Monte Carlo simulation, and use during the planning phase of road projects.

The seven processes are an extension of the ISO 31000 framework and provide more detailed and actionable guidance. ISO 31000 says why and what to do at a strategic level, whereas PMBOK will demonstrate how these activities can be done on the project level. Both frameworks collectively offer a comprehensive framework for strategic risk management in the Nepalese road infrastructure sector, which has a significant impact on the outcomes of projects that are planned for the future (Vargas & Campos, 2022; Ogbebor, 2024).

The 7th edition focuses more on principle-based approach (One of the 12 Project Management Principles is Optimize Risk Responses) and incorporates risk within other performance areas, particularly the Uncertainty Performance Domain. It has a focus on adaptability, systems thinking, and value delivery, but still maintains the practical tools of the previous editions (Project Management Institute, 2021).

The advantage of PMBOK is that it provides comprehensive and concrete instructions, specific to the phases of a project. It explicitly calls for stakeholder engagement and iterative processes, which dovetail nicely with infrastructure projects that involve planning, design and construction (Vargas & Campos, 2022).

2.2.3 Comparison and Integration of ISO 31000 and PMBOK

There are many common elements to both frameworks: iterative, with a focus on stakeholders, and with a strong commitment to decision-making integration. They are organized around a PDCA-like logic, going through identification, analysis, response/treatment, and monitoring (Vargas & Campos, 2022). There are two main distinctions, first the prescription (low vs. high) and second the scope.

Table 1: Comparison of Risk Management Processes – ISO 31000:2018 vs. PMBOK Guide

Aspect	ISO 31000:2018	PMBOK Guide
Scope	Organizational context	Project specific

Approach	1. Principles 2. Framework 3. Process	1. Process groups 2. Knowledge area
Key Processes	6 steps	7 steps (project lifecycle)
Analysis	Qualitative or Quantitative (flexible)	Explicit Qualitative + Quantitative
Treatment/Response	Broad risk treatment	Detailed response strategies with implementation
Certification	Not certifiable	Supports PMP certification
Flexibility	High (customizable)	Moderate (tailoring encouraged)

Source: (Vargas & Campos, 2022; Project Management Institute, 2017; ISO, 2018)

Table 1 provides a concise comparison of the two dominant risk management standards and demonstrates the complementary but different nature of the standards. ISO 31000:2018 has a wide scope and can be applied across the enterprise in any situation. It is based on guiding principles, a supporting framework and a flexible and iterative process comprising six major activities. The PMBOK Guide on the other hand is a more project specific approach with seven detailed processes embedded in the project life cycle.

One of the major areas of distinction is related to the way they handle risk analysis and response. ISO 31000 is very flexible and can be either qualitative or quantitative analysis (not prescriptive), PMBOK definitely mandates both qualitative and quantitative techniques and has detailed guidance on planning and taking action on risk responses. The ISO 31000 is not certifiable and is about customization, as PMBOK is about professional certification (PMP) and tailoring within a structured framework.

This comparison is very relevant to the road infrastructure projects in Nepal. The principles of ISO 31000 are general and flexible, and can be applied to the level of institutional risk governance in a multi-level federal system, while the processes of PMBOK can be applied by project teams as they plan and execute projects. Combining both approaches can facilitate the gap between the policy and project realities on the ground (Vargas & Campos, 2022; Ogbebor, 2024).

Empirical research indicates that a combination of the two obtains better results. For example, ISO 31000 is an approach which can be used in enterprise-wide governance

for organizations in developing countries, while PMBOK can be used for specific infrastructure projects (Mazher et al., 2022; Ogbebor, 2024 as referenced in original draft). Such integration in the road sector in Nepal, where the sector has a number of projects, is a way to link formal standards with local practice (Koirala, 2017; Butchers et al., 2021).

But there are still some application issues. Often, there is limited technical capacity and data is scarce, leading to a more superficial adoption, where experts rely more on their judgment than on formal tools (Tserng et al., 2021; Mazher et al., 2022). Recent literature has suggested the need of context-specific hybridization – adapting ISO principles and using PMBOK tools, while also considering local factors, such as political risks and geotechnical uncertainties, in Himalayan infrastructure (Singh et al., 2020; Korytárová & Hromádka, 2020).

To sum up, ISO 31000 and PMBOK offer strong and complementary bases for strategic risk management. They need to be technically implemented in the country's road infrastructure planning, but also interact with Nepal's federal governance structure and the challenges of resource constraints and multi-stakeholder landscapes. This lays the groundwork for discussing more general infrastructure risk performance problems in later sections.

2.3 Risk and Performance issues in Infrastructure Projects

Despite the huge capital investments on the tools and know-how of project management, large-scale projects, especially road development projects, invariably fall short. This section investigates the systemic performance gaps in such projects, namely the megaproject paradox, behavioural and strategic theories of why projects don't perform well and the pivotal importance of the planning phase as a source of risks.

2.3.1 The Megaproject Paradox

This “megaproject paradox” was starkly conceptualised by Flyvbjerg (2003) and is the intriguing fact that, despite the sophistication of project management practices and tools over time, very large and complex infrastructure projects routinely experience massive cost overruns and schedule delays. Based on his extensive research on

hundreds of megaprojects from around the world, Flyvbjerg has established that cost overruns of 50-100% and schedule delays of several years of a megaproject are not the exception to the rule (Flyvbjerg et al., 2003).

This is true not only in the various sectors, but also in the various regions. Daunfeldt (2025) carried out an in-depth study of a large public infrastructure project in Sweden, which revealed significant cost overruns even after considering external factors like the COVID-19 pandemic and inflation, as a result of internal organising failures and unrealistic planning expectations. The cost overrun for transportation sector projects has been reported to be on average 44.7% for road projects, and higher cost overruns are often reported in developing countries (Korytárová & Hromádka, 2020). The paradox is evident in the current situation of the road expansion from Narayanghat to Butwal which is facing several postponements and delays of completion, particularly the difficult stretch of Daunne in Nepal.

The megaproject paradox implies that bad performance of megaprojects is not necessarily due to bad luck or unexpected events, but is instead entrenched in the planning, approval, and governance processes of megaprojects.

2.3.2 Optimism Bias and Strategic Misrepresentation

According to Flyvbjerg (2009) there are two main factors contributing to the megaproject paradox: optimism bias and strategic misrepresentation. Optimism bias is a cognitive bias that is the tendency of planners and decision makers to underestimate costs, durations, and risks, and overestimate benefits. This psychological bias makes project sponsors feel that their project will better than what history shows (Lovallo & Kahneman, 2003).

Deliberate political behaviour on the other hand, is strategic misrepresentation, which are the deliberate understating of costs and overstating of benefits to make a project more likely to be approved and funded. This behavior can be due to principal-agent issues, where promoters reap political and/or personal rewards for undertaking the project and taxpayers absorb the financial and social costs (Lovallo et al., 2023).

Both of these mechanisms are important in terms of risk management. Optimism bias leads to under-preparedness in identifying risks and providing contingencies in the planning phase. The strategic misrepresentation undermines governance mechanisms that should provide for realistic forecasting and accountability. These biases are further exacerbated in low-income nations such as Nepal due to powerful political pressures to embark on large visible infrastructure project, lack of institutional monitoring and supervision, and scarcity of dependable past project performance data (Koirala, 2017; Magwedere & Marozva, 2023).

2.3.3 Planning Phase as Critical Risk Source

Literature increasingly is confirming that most project risks are developed and "locked up" during the early planning phase of the project. Path dependency resulting from decisions made during the conception of the project, feasibility studies, detailed design and pre-construction approvals is very difficult and expensive to change later on in the project (Williams & Samset, 2010; Tserng et al., 2021; Korytárová & Hromádka, 2020).

A lack of geotechnical investigations, unrealistic schedules and cost estimates and a lack of contingency planning during the Front End phase often results in significant implementation issues. If solid processes are applied during the planning phase, it is possible to identify and mitigate 70-80% of project risks. The segment Daunne of the road between Narayanghat-Butwal in the Nepalese context is an ar prototype for this: first there was difficulty with the complex terrain, and then with the land acquisition, causing the project to be delayed and costs to skyrocket.

2.4 Risk Management issues in developing countries

International approaches for risk management (such as ISO 31000:2018 and the PMBOK Guide) offer extensive guidance, but there are unique and significant challenges in developing countries regarding the application of these approaches. The institutional, political and coordination-related weaknesses are the root cause of such challenges, and they have a strong negative impact on the effectiveness of formal risk management practices.

2.4.1 Weaknesses in Institutions and governance

Chronic institutional weaknesses are often faced in developing countries that limit the effectiveness of risk management. These include limited technical capacity in implementing agencies, disjointed organisational structures, inconsistent adherence to rules and procedures as well as weak implementation of accountability mechanisms (World Bank, 2019; Mazher et al., 2022). Formal risk management standards are based on the premise that competent, well-resourced and co-ordinated institutions are in place, which is not always the case in resource-constrained environments.

There are institutional capacity gaps at federal, provincial and local levels in Nepal. Many agencies do not have enough trained staff, data systems or up-to-date tools for risk assessment. Consequently, even if international standards are technically implemented (usually because of donor prescriptions) they are usually superficial or only documentational, not carried out as part of the organisation (Koirala, 2017). Reactive, experience-based risk handling to proactive and systematic risk handling is not easily achieved due to this institutional fragility.

2.4.2 Political and Regulatory Instability

Another major constraint in developing countries to efficient risk management is political and regulatory instability. A number of projects have experienced frequent changes in government, changes in policy focus and even political interference, leading to a disruption of project continuity and additional uncertainty (Magwedere & Marozva, 2023; Butchers et al., 2021). Projects are often started or expedited in many cases for short term political reasons, not for the long term technical/economical viability.

Regulatory regimes in developing countries are also subject to sudden changes, such as that of environmental clearances, land acquisition and procurement. These changes generate a lot of uncertainty for project planners and project implementers. Transition in the federal structure between varying levels of government also contributes to making the process of providing regulatory continuity and decision-making in Nepal more difficult. The pressure of political decisions to get things moving quickly can result in poor planning, unrealistic time schedules and a lack of risk assessment, all of which

can directly contribute to the optimism bias and strategic misrepresentation mentioned above.

2.4.3 Multi-Agency Environment Coordination Failures

Typically, infrastructure projects in developing countries involve many stakeholders, ranging from different government agencies, international donors, consultants, contractors to local communities. In order to achieve effective risk management, there must be effective coordination among these various actors. However, coordination failures often occur due to overlapping jurisdictions, lack of communication, conflicting priorities and delays in the bureaucracy (Tserng et al., 2021).

It can be seen from the Daunne stretch of the Narayanghat-Butwal road project in Nepal. The lack of collaboration between agencies and split responsibilities in land acquisition, environmental approvals, tree clearing and utility relocation were among the causes for delays. Federal agencies may continue to have an official role, and local government may be involved in addressing community issues but do not have sufficient power. Such diffusion of responsibility obscures responsibility and delays mechanisms to respond to risk.

The lack of information sharing, lack of integrated data systems and competing institutional interests only intensify such coordination challenges. Consequently, risks that are raised at the planning stage are not well communicated or managed among agencies, and are then dealt with reactively as they arise in implementing the plan.

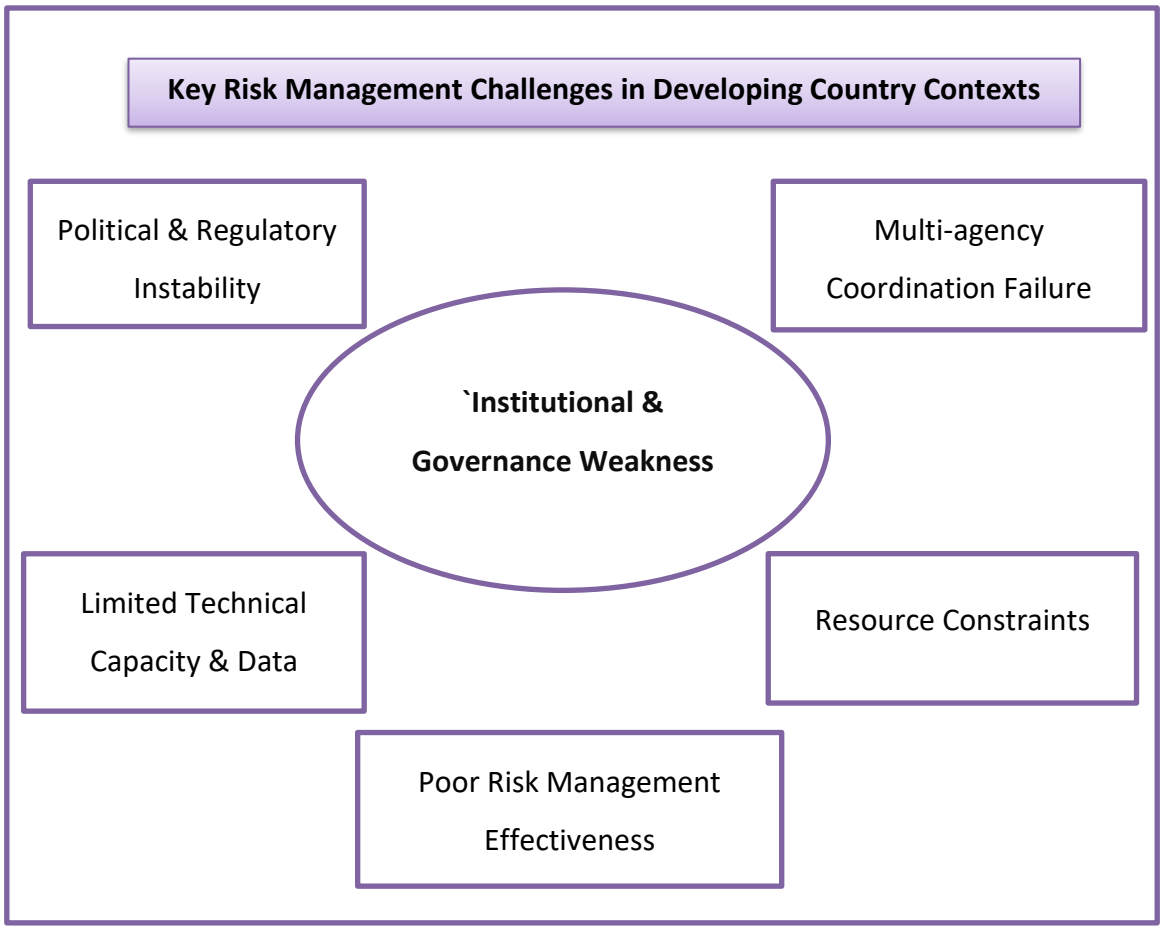

Figure 4: Key Risk Management Challenges in Developing Country Contexts

Source: (Mazher et al., 2022; Sikhupelo, 2023; World Bank, 2019)

The difficulties of weak institutions, political instability, and bad multi-agency coordination make it hard to translate international risk management standards to good practices. These contextual factors contribute to the understanding of the informal and experience-driven nature of risk management in countries such as Nepal, which is mostly reactive. To create context specific solutions for enhancing strategic risk management in the Nepalese road infrastructure projects, it is essential to understand these challenges.

2.5 Nepal's Road Infrastructure Sector: Context and Challenges

Road infrastructure is an important element of Nepal's topography, which ranges from the Terai plains to the Himalayan mountains, and is a lifeline for the economic

development, social integration and regional connectivity of this landlocked country. But there are ongoing problems in the sector with regard to planning, implementation and risk management. Of this, a sector background, the institutional framework, key implementation issues and the role of international development partners are briefly outlined.

2.5.1 Sector Background and Institutional Framework

In the last couple of decades, Nepal has witnessed huge development in the road infrastructure. Asian Transport Observatory (2025) estimates that the total road length has increased from about 1.5 km/1000 people in 2000 to about 3.9 km/1000 in 2024, and that the road network is now more than 115,000 km in total. The network is split into the Strategic Road Network (SRN) and Local Road Network (LRN) with the SRN being in federal control and the LRN under Provincial and Local control.

The Department of Roads (DoR), Ministry of Physical Infrastructure and Transport (MoPIT) is the main body to plan, construct and maintain national highways and strategic roads. Roads Board Nepal (RBN) has been formed under Roads Board Act 2002, to operate a fund for road maintenance. Since the implementation of federalism in 2015, the government has a multi-level governance system that involves three layers of government sharing responsibilities (Government of Nepal, 2024).

This institutional structure provides for local decision making and raises coordination challenges. DoR currently administers approximately 70 projects, with some 2,200 technical staff, with local governments administering most of the rural and district road networks (World Bank, 2025).

2.5.2 Key Implementation Challenges and Past Performance

Although significant progress has been made, there are still challenges in implementing road infrastructure projects in Nepal. Some of the common problems are related to land acquisition, delay in environmental clearance certificate (IEE/EIA), geotechnical issues (due to difficult terrain), contractor issues (poor performance) and funding issues (Koirala, 2017; Sharma, 2025).

Narayanghat-Butwal Road Expansion Project is one of the notable ones. The project was contracted in December 2018 and the initial completion plan was for 42 months which has been extended a number of times. The physical progress is around 74% and for the technically challenging Daunne stretch, it is around 50% as of the end of 2025 (Sharma, 2025). Challenges to the pace of handover include: slow handover of sites, delays in permits for tree cutting and utility relocation, local government restrictions on materials extraction, and coordination between Federal and local agencies.

These challenges relate to systemic issues, such as unrealistic planning assumptions, poor risk assessment at feasibility stage and institutional fragmentation. Land acquisition, environmental approvals and coordination amongst various agencies have been identified as key bottlenecks in annual reports of the DoR (Government of Nepal, 2024).

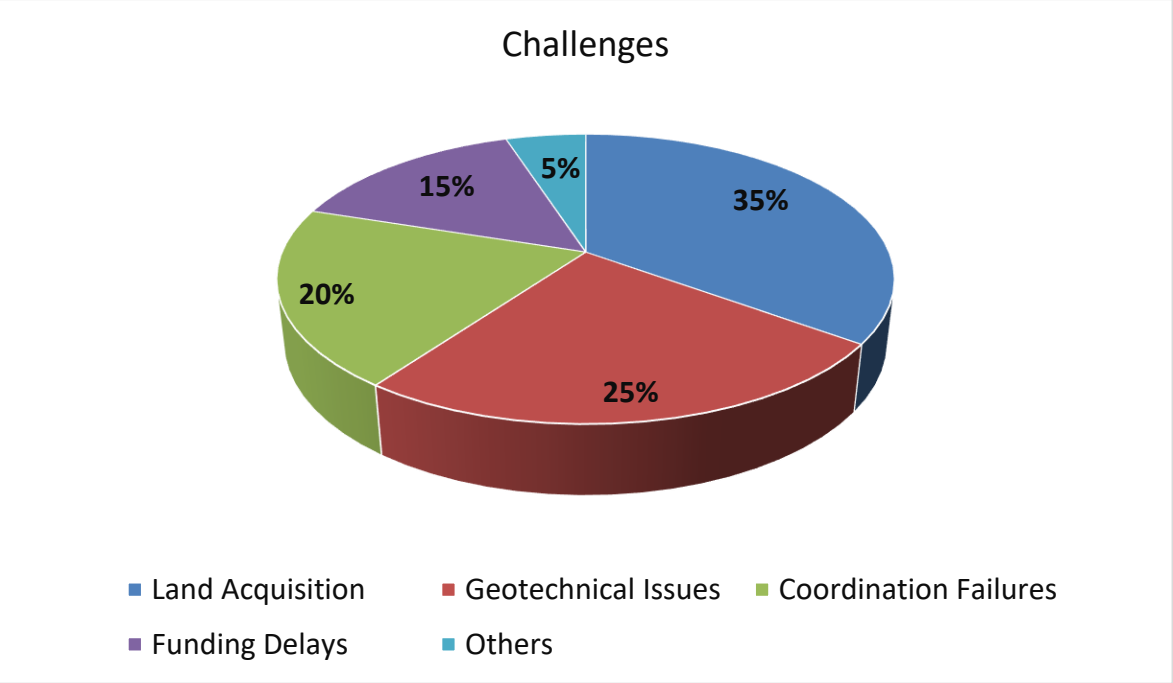

Figure 5. Major Challenges in Nepal's Road Infrastructure Projects

(Source: Adapted from Koirala, 2017; Sharma, 2025; Department of Roads Annual Reports)

Figure 5 shows the most prominent problems encountered for road infrastructure projects in Nepal from the reported problems. Land acquisition is identified as the

biggest challenge (35%), and geotechnical issues (25%) dealing with unstable slopes and difficult terrain are the next biggest challenges. Funding delays are responsible for 15% and coordination failures among different government agencies for 20%. The rest 5% is in the category of “Others”.

The distribution clearly shows that the number of non-technical and institutional problems is significantly higher than the number of technical problems: land acquisition and inter-agency co-ordination are the predominant issues. This result further highlights the need to build up front end planning, stakeholder engagement and governance mechanisms in the planning process of road projects in Nepal.

2.5.3 International Development Partners' role

Nepal's road sector is highly relying on the support of international development partners in terms of financing, technical expertise and knowledge on risk management. The biggest donors are the World Bank and Asian Development Bank (ADB). Some of the key projects include the World Bank's Strategic Road Connectivity and Trade Improvement Project and Geohazard Risk Management projects, which are focused on climate resiliency, road safety, and institutional strengthening (World Bank, 2025).

ADB has been involved in big ticket roads like East-West Highway upgrade and is also actively engaged in capacity building on road asset management and climate resilient road designs. In addition, these partners may have to follow international best practices, such as ISO 31000 and PMBOK, for formal implementation of risk management in donor-funded projects (ADB, 2025).

But, there is a huge divergence between project specific risk management approach adopted by the donors and the routine practice of the agencies in Nepal. International support has introduced new tools (such as GIS-based risk mapping and multi-hazard assessments), but these are not being used regularly because of capacity and varying priorities (Butchers et al., 2021).

To conclude, road sector in Nepal has achieved remarkable progress in the development of road network, yet, the efficiency of implementation and risk management remains a challenge. Future success will be strongly dependent on better coordination and

institutionalization within the country, better front-end planning, and more holistic incorporation of lessons learnt from international partners.

2.6 Research Gap and Conceptual Framework

2.6.1 Synthesis of Literature

The literature examined in this chapter shows a number of recurring issues and concepts in managing risk in infrastructure projects. There are systematic, principles-based, and process-based frameworks that can help in identifying, analysing, evaluating, and treating risks, including international standards like the ISO 31000:2018 and the PMBOK Guide (International Organization for Standardization, 2018; Project Management Institute, 2017). However, due to contextual constraints their application is limited in developing countries.

Research on megaprojects always has pointed to a ‘megaproject paradox’ of endless escalation of costs and construction delays, caused by strategic misrepresentation and the optimism bias (Flyvbjerg, 2009, 2014). Institutional weaknesses, political instability, and coordination failures among multiple agencies further exacerbate these issues in developing countries (Mazher et al., 2022; Magwedere & Marozva, 2023). The main issues found in the Nepalese context in road projects are land acquisition, geotechnical problems, funding delays, and governance issues (Koirala, 2017; Sharma, 2025).

Table 2. Summary of Literature on Road Project Delays in Nepal and Developing Countries

Author/Year	Country	Main Risks Found	Method	Gap Addressed
Koirala (2017)	Nepal	Financial risks, institutional capacity, planning gaps	Qualitative review	Identifies major risk factors but lacks empirical focus on planning phase
Subedi & Joshi (2020)	Nepal (Gandaki Province)	Land acquisition, weather, coordination failures	Questionnaire survey	Provincial-level road delays; limited national perspective
Bhattarai (2023)	Nepal	Inadequate planning, design changes, material shortages	Literature review & analysis	General construction delays with road relevance
K.C., Awasthi & Bohara (2025)	Nepal	Stakeholder communication, site handover, COVID-19	Correlation & cluster analysis	Completion-stage analysis; weak focus on early risk management
Shrestha et al. (2025)	Nepal	Delays in Narayanghat-Butwal project	Stakeholder perception study	Project-specific completion stage risks
Mazher et al. (2022)	Developing Countries	Risk allocation in PPP infrastructure	Systematic review	Strong on global practices but weak Nepal-specific context

2.6.2 Identified Research Gaps

Although there's been a lot of literature on infrastructure risk, there are still substantial gaps. Firstly, most studies have been conducted in the construction or implementation stage, but many potential risks emerge during the planning stage and become committed (Williams & Samset, 2010; Tserng et al., 2021). Second, there is a lack of empirical study to investigate the contemporary practice of risk management by practitioners in the road sector, especially in the context of the new federal governance in Nepal. Third, the international frameworks (ISO 31000 and PMBOK) are often suggested but little research looks at the differences between these and local practice in resource poor and multi-level governance settings such as Nepal. Lastly, there is insufficient representation of the voices of practitioners at federal, provincial, local and private levels in academic research.

This study seeks to fill these gaps by examining the strategic risk management practices particularly in the planning stage of road infrastructure projects in Nepal using the lens of project professionals' lived experiences.

2.6.3 Conceptual Framework

The conceptual framework that the study will take, based on the literature review, is that risk management during the planning stage is at an intersection of formal structures, institutional context, and professional practice. The framework understands that:

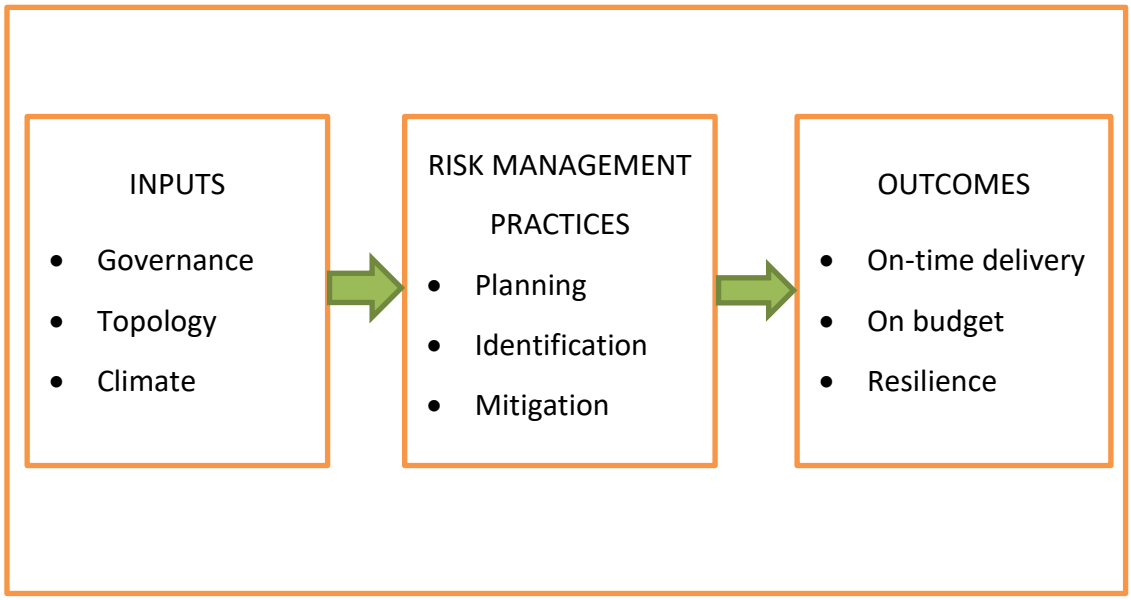

Figure 2. Author's conceptual framework linking contextual inputs to risk management practices and project outcomes.

- Risk identification, analysis, and mitigation are processes that are prescribed by formal risk management frameworks (ISO 31000, PMBOK).

- These processes can be realised in institutional context (organisational structures, coordination mechanisms, governance arrangements) which conditions their implementation.
- Both framework guidance and institutional constraints are manifested in professional practice (the real work of project professionals).
- The distance between the recommended processes and the reality is the gap where the risks at the planning stage can be poorly handled.

This theoretical framework informs the empirical inquiry by placing the emphasis on the actual activity of the professionals (practice), the perceived institutional environment (context), and the relationship between the activity of the professionals and formal frameworks (prescription).

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Research Design

The study used qualitative research design to investigate strategic risk management practices in the planning phase of road infrastructure projects in Nepal. Qualitative research has been chosen as the approach to study because it is well suited to the exploration of complex and context-specific organizational and professional practices, where human perception, institutional conditions and socio-political factors are at the heart of the study (Creswell & Poth, 2018). Quantitative methods would not have been able to reflect the complexities with which project professionals actually interpret, situate and manage risks in the context of Nepal where the topography is extreme and there is a multi-level government, resource constraints, and the frequent occurrence of political instability. Rather, design was based on an interpretivist paradigm, which assumes that reality is socially constructed and that knowledge can be best developed by interpreting the subjective meanings participants give their experiences (Saunders et al., 2019).

The study was exploratory and descriptive in nature and qualitative in design. The exploratory components enabled the researcher to gain insights into emerging patterns and unexpected aspects from practitioners across multiple levels within their organisations, whereas the descriptive component gave the researcher rich, detailed descriptions of the current reality of practitioners' risk management. This design directly contributed in achieving the research objectives: identification of major risk in the planning stage, analysis of identification and mitigation process, comparing with International standards (ISO 31000:2018, PMBOK Guide), and formulation of contextually applicable recommendations. The research examined a gap in the literature, as most studies did not examine the planning phase but implementation or construction phases, focusing only on planning phase from project conception to feasibility studies and detailed design to pre-construction approvals. The qualitative design also matched the study focus on professional practice in real institutional settings, allowing the participants to discuss real-life examples of projects in Achham

and Bardiya, such as rural roads, and in the national highways, such as Narayanghat-Butwal. Overall, the design emphasis was on depth, context and practical relevance rather than breadth and statistical generalisation, and it was well suited to the research questions and the context of infrastructure development in a developing country.

3.2 Qualitative Method

The major data collection technique was semi-structured interviews. The approach selected was a compromise between structure and flexibility to be able to cover all the major issues in a systematic way and give the participants room to expand on the issues that were most important to them and their experiences (Kvale & Brinkmann, 2009). A comprehensive interview guide was prepared and grouped into seven thematic areas that included information about the participants, identification of risk in the planning phase, risk analysis and evaluation, risk mitigation strategies, governance and co-ordination challenges, effectiveness of current practices, and recommendations for improvement. The guide featured open-ended questions with probes to help elicit depth of answers and real-life examples. The guide was pre-tested by 2 experienced engineers to ensure clarity, cultural appropriateness and logical flow before full deployment, with minor tweaks based on their feedback.

The standard time for each interview ranged from 15 to 30 minutes, enough to meet participants' professional demands and produce ample data. Interviews were carried out in English or Nepali, as participants preferred, and translated from Nepali and checked for accuracy. The semi-structured format was very effective as risk management is not solely a technical process but is rooted in the relational, political and resource constraints in Nepal. The participants were often able to provide anecdotes about the projects, for example, when land acquisition was involved, problems in hilly areas, or coordination issues between the federal and local governments, which would have been harder to obtain using more traditional survey instruments. This approach also allowed for the gathering of both semantic (surface level description) and latent (underlying assumptions and institutional barriers) data, giving a comprehensive view of the perception, adaption and/or neglect of formal structures such as ISO 31000 and

PMBOK in practice. Responses were verbatim recorded using audio recording and with explicit consent.

3.3 Research Procedure

The data was collected from February to April, 2026. Potential participants were identified using 1) purposive sampling and 2) professional referrals from the Department of Roads, local governments, engineering consultancies and construction companies. Contact was made by an email or phone, a detailed Participant Information Sheet and informed consent form were sent. After obtaining consent, the interviews were conducted at a time and place convenient to the interviewees, both in-person in Kathmandu and at the project sites, and online using secure platforms like Zoom and Microsoft Teams. All interviews were taped with the consent of the interviewees.

The researcher listened to the recorded interview immediately after the interview and took reflective field notes that included initial impressions, non-verbal cues and contextual notes. The researcher did verbatim transcription within 48 hours, to maintain accuracy and linguistic nuances. Translation by professional was used in Nepali when participants spoke in Nepali and verified. Transcripts were then sent back to participants for member checking, where appropriate, so they could clarify and/or correct any inaccuracies. This process was repeated to increase the validity of the data. Every raw data, such as recordings and transcripts, were kept on devices with passwords and managed according to data protection measures. The protocol was designed to keep the participant burden to a minimum and ensure the quality and ethical nature of the data.

3.3.1 Selected Interviewee

The required sample size was based on the 10 to 15 participants that have been found to be appropriate for a thematic saturation in qualitative research of an organised practice (Guest et al., 2006). In the end, twelve professionals were involved in the study. The participants had a range of experience from 2 to 11 years of relevant experience, offering operational first-hand experience and senior level strategic perspectives. They performed functions related to policy/governance, detailed design, construction supervision, feasibility studies and planning. Both the geographical and project

interventions covered the Terai plains and hilly/mountainous areas, reflecting the various topographic and climatic conditions. The final sample was a good mix of organisations and professions, allowing the shared patterns to be identified, as well as the variations in the level of risk management practice found in context.

Table 3. Detailed Description of the Participants.

Participant ID	Organization / Affiliation	Position / Role	Years of Experience	Primary Involvement Areas
P01	Rural Municipality (Achham)	Civil Engineer	2	Planning & Construction
P02	IOE, Pulchowk Campus, Tribhuvan University	Assistant Professor	4	Academic / Research
P03	Road Division, Dang	Engineer	11	Construction / Supervision
P04	Department of Roads (DoR)	Engineer	3	Construction / Supervision
P05	Department of Roads (DoR)	Highway Engineer	10	Construction / Supervision
P06	National Novel Engineering Consultancy / DUDBC	Engineer	5	Construction / Supervision
P07	Madhuwan Municipality, Bardiya	Head of Infrastructure Development Section	8	Planning, Design, Construction & Governance
P08	Religare Construction Pvt. Ltd	Site Engineer	3	Construction / Supervision
P09	K.A.P Construction Pvt. Ltd.	Engineer & Owner	5	Construction / Supervision
P10	National Engineering Consultancy	Site Engineer	4	Planning / Feasibility + Supervision
P11	Extra Tech International	Site Engineer	3	Construction / Supervision
P12	Mangalsen Municipality, Achham	Engineer (Head of Infrastructure Branch)	6	Planning, Design, Supervision & Governance

3.3.2 Data Analysis

Thematic analysis was used on all transcribed interviews according to the six phases of thematic analysis proposed by Braun and Clarke (2006, 2019). This approach was selected because it systematically and flexibly helped to identify, organise and interpret

patterns of meaning in qualitative data. In the analysis both inductive (data driven) and deductive (theory driven) coding was used. It started with extensive familiarisation; many times reading the text, and hearing the text. Initial codes were then created and both explicit (e.g. risks stated) and latent (e.g. underlying institutional barriers) meanings were captured. Systematic coding, memo writing and developing themes were facilitated by NVivo qualitative data analysis software. Codes were then pulled together in regards to the candidate themes and then reviewed for coherence before undergoing iterative comparison throughout the data set. For each theme, a definition, a name and pertinent quotes from the participants were given. The final thematic structure directly addressed the questions of this research and comparison with ISO 31000:2018 and PMBOK Guide principles was possible. There was a high degree of analytical rigour as a result of regular peer de-briefing with academic supervisors.

3.3.3 Trustworthiness of the Study

The criteria of credibility, transferability, dependability and confirmability of Lincoln and Guba (1985) were applied to establish trustworthiness. Member checking, prolonged engagement with the data and provision of rich, thick descriptions added to credibility. Detailed contextual information around participants, organisations and the road sector in Nepal, supported transferability. They reached dependability by ensuring that a full audit trail of all the analytical decisions made was kept. Confirmability was enhanced by researcher reflexivity; the researcher kept a reflexive journal to come to terms with and combat their own preconceived notions stemming from previous engineering experiences in Nepal. All these approaches enhanced the methodological soundness and reliability of the study findings.

3.4 Research Sampling

To gather information-rich samples, a purposive sampling method, with some snowball sampling, was used in order to obtain different and informative viewpoints about strategic risk management (Patton, 2015). The approach purposefully aimed at key professionals in hands-on roles in Nepalese road infrastructure projects from a variety of groups, including federal government agencies (Department of Roads), provincial and

local government (rural municipalities and municipalities), engineering consultancies, private contractors, and academia. The multi-stakeholder approach was crucial because of the complex governance of road projects in Nepal, with risks occurring at the intersection of federal policy, local implementation, donor needs and community expectations.

3.5 Ethical Considerations

The Research Ethics Committee gave ethical approval before any data were collected. All participation was on a voluntary basis. All the interviewees were given a clear Participant Information Sheet and gave written informed consent. The confidentiality and anonymity were kept by using the Participant IDs and removing all identifying details. Audio recordings and transcripts were securely stored on password protected devices and to be destroyed after the required retention period. Each participant was told they could stop whenever they wanted to for any reason without any consequences. There were no conflicts of interest and reflexivity was practiced throughout to ensure respect, beneficence and justice.

To sum up, the methodology used for this study was carefully planned to provide reliable and context specific knowledge regarding strategic risk management practices in road infrastructure projects in Nepal. The use of purposive sampling technique, semi structured interviews and thorough thematic analysis guaranteed a meaningful interpretation of experienced professionals' voices. The results of this process are presented in the next chapter.

CHAPTER 4: RESULTS

The findings of the 12 semi structured interviews with professionals with first hand experience in road infrastructure projects in Nepal are presented in this chapter. Twelve participants from a wide range of stakeholder groups, including Department of Roads (Federal level), local governments (rural municipalities), engineering consultancies, construction companies and academia, were interviewed and gave rich and contextual information about strategic risk management practices in the planning phase. The interviews yielded rich descriptions of challenges, practices, and gaps in risk management in the real world. Thematic analysis was used to analyse the data following the outlined steps of Braun and Clarke (2006, 2019) and with the help of the NVivo qualitative data analysis software. The analysis was conducted in six phases, a mixture of deductive coding (aimed at the research questions and the conceptual framework used in Chapter 2) and inductive coding (which sought to uncover new patterns that arose from the participants' stories). This dual approach ensured that findings were well grounded in the data, and at the same time allowed for systematic comparison with international standards (ISO 31000:2018 and PMBOK Guide).

This chapter's thematic organization provides a direct link to the main research question as well as to the supporting questions of this study. Themes were constructed using iterative coding, constant comparison of the transcripts and regular peer de-briefing, thus increasing the rigour of the analysis. For clarity, a conceptual mind map is presented in Appendix 2 which presents the interconnections among the main themes and sub-themes. In order to demonstrate the main patterns and to retain the authenticity of the professionals' voices, quotations from the participants are used throughout the chapter in large numbers. To ensure anonymity, pseudonyms in the form of Participant IDs (P01–P12) have been used, which makes it possible to trace individual contributions in the themes.

The results are presented in five main sections which follow the elements of strategic risk management in the planning phase. The first section points out the most frequent hazards encountered in planning. The next sections discuss the identification, analysis

and prioritization of these risks, mitigation measures in place and an overall evaluation by participants of the effectiveness of the current mitigation measures, as well as the role of governance and coordination. For each theme, there are frequency counts and illustrative quotations, and in some cases summary tables or figures that illustrate trends across the sample. These findings indicate a similar picture with much of the practical knowledge and experience being held by professionals, and risk management being informal, reactive and relying heavily on the individual professional knowledge and practices rather than systematic and institutionalised processes. The chapter ends with a summary of key patterns that were identified and serves as a transition to the analysis of the study's findings with the literature and the conceptual framework of the study.

The variety of the participant group from federal and local government, consultancies, contractors, and academia enabled the identification of commonalities and variations in context. The views and experiences were from projects in the Terai plains and hilly/mountainous areas, reflecting the impact of the extreme topography of Nepal on risk management. Experience levels varied from 2 to 11 years, offering a mix of operational and strategic viewpoints between young and experienced engineers. This heterogeneity enhanced the trustworthiness and richness of the thematic analysis. The results below are explained in a way that allows for a faithful description of what is experienced by the participants, and that is followed by a clear focus on the planning process underlying road infrastructure projects.

4.1 Most Common Risks Encountered During the Planning Stage

Through thematic analysis of the interviews with twelve professionals, a consistent and multifaceted set of risks that typify the planning stage of road infrastructure projects in Nepal were identified. Seven general categories of risks were repeatedly mentioned and are highly interdependent and interconnected, driven by the country's harsh terrain, weak central government, scarce resources and social and political dynamics. The risks are not merely individual but systemic issues that start from the planning process and can have a profound impact on project outcomes. The results reveal a high level of similarity among federal, local, consultancy, and contractor responses, suggesting that

these risks are shared among organisations and between rural and urban areas (Terai plains and hilly/mountainous districts).

Geotechnical and Topographical Risks was the most commonly mentioned risk category. Nearly all participants reported that landslides, unstable slopes and mass movements and difficult terrain were a daily risk. P03 (Road Division Dang) said *"Geological hazard like landslide, mass movement etc."* while P04 (Department of Roads) mentioned *"Geotechnical instability (landslides)"* as one of the major concerns, particularly in Karnali region. P06 pointed out lack of proper hydrological and geological data while P10 stated that *"landslides and unstable slopes especially in hilly areas"* often result in delays at the outset. P07 shared the information from the Terai that landslides are not so frequent, but there are still serious geotechnical problems due to low bearing capacity and soft soil. These risks were frequently related to poor initial site investigations and unrealistic assumptions in Detailed Project Reports (DPRs).

The second most common challenge was Land Acquisition and Social Risks. Recurring obstacles reported were lengthy negotiations, community opposition, compensation issues, and loss of agricultural land. P01 explained that, *"Land Acquisition & Social Risks: As remote place the only income source is agriculture in hilly district, Nowadays machine oriented works are preferred & it destroys the whole agricultural land."* P05 included the *"Issues with land acquisition"* along with the demands of the people for link road development. P08 has pointed out that land acquisition and compensation delays *"frequently cause delays in securing land for approach roads and bridge sites due to local disputes."* P09 and P12 also pointed out the fact that early consultation with the local community is not fully done which results in opposition and delay in projects.

There was widespread reporting of **Budgetary and Financial Risks** as an underlying issue. Some of the hindering factors participants often cited were unrealistic cost estimates, insufficient grants and under-allocation of budget. P01 clearly stated *"Financial Risk: Insufficient Grants from Federal & provincial Government & no income sources generated on local level, this is the main risk to construct big road projects."* P02 mentioned *"Allocation of less budget and time in planning and design"* while P07 said *"Budget underestimation due to poor feasibility studies."* Some of the participants (P04,

P05, P09) connected these financial issues with political pressure to begin projects quickly without resources.

Several participants mentioned the challenges of **Environmental and Regulatory Risks**, including the delay in getting IEE and EIA approvals. P01 referred to *"Environmental Risks: The verification of IEE & EIA Reports etc."* and P06 identified *"Environment and climatic factor"* as one of the major planning risks. P04 and P12 also reported that environmental clearance procedures can be a major obstacle in the planning process.

Political, Regulatory and Governance Risks were referred to as 'pervasive and disruptive'. P05 identified *"Political interference in project selection"* and *"Weak intra government bodies coordination."* P08 noted that political and regulatory uncertainty have an impact on the *"policy formation, budget allocation, administration management, technical management, decision making etc."* P11 pointed out *"Political influence and delays in approvals"* and P12 noted that sometimes *"sometimes political pressure to start projects quickly"* making on projects that can lead to budget underestimation."

Coordination and Stakeholder Risks reflected the multi-agency nature of road projects. Participants noted that there are overlapping jurisdictions, lack of information sharing, and competing priorities between the federal, provincial, and local governments. P05 mentioned *"Weak intra government bodies coordination",* P11 mentioned *"Large number of associated agencies*" and *"Poor historical data".* P10 highlighted the need for gaps in communication and community representative involvement as a requirement and challenge.

The remaining pieces of the puzzle were **Design, Data, and Feasibility Risks**. The participants highlighted the poor quality of initial surveys, the irrelevant DPRs, and unrealistic designs. P01 said, *"Design & Data Risks: Due to difficult terrain the DPR reports are irrelevant & false & very risky in designing & fixing the alignment."* P02 and P06 also voiced concerns of *"rough technical and environmental assessments"* and limited availability of data.

Table 4. Most Common Risks Encountered During the Planning Stage

Risk Category	Key Examples	Main Interdependencies	Representative Quote
Geotechnical / Topographical	Landslides, unstable slopes, difficult terrain	Design/data, financial, land acquisition	"Geological hazard like landslide, mass movement etc."
Land Acquisition / Social	Compensation delays, community opposition	Political/governance, coordination	"Land Acquisition & Social Risks… destroys the whole agricultural land."
Budgetary / Financial	Unrealistic estimates, insufficient grants	All other risks	"Financial Risk: Insufficient Grants from Federal & provincial Government…"
Environmental / Regulatory	IEE/EIA delays, climatic factors	Coordination, political	"Environmental Risks: The verification of IEE & EIA Reports etc."
Political / Governance	Interference, policy changes	Coordination, all	"Political interference in project selection"
Coordination / Stakeholder	Multi-agency failures, communication gaps	Governance, all	"Weak intra government bodies coordination"
Design / Data / Feasibility	Poor surveys, irrelevant DPRs	Geotechnical, financial	"DPR reports are irrelevant & false & very risky…"

Table 4 shows seven major risks, which were identified by 12 participants during the planning phase of road infrastructure projects in Nepal and are highly interdependent. The most commonly mentioned were the Geotechnical/Topographical risks and the Land Acquisition/Social risks, in view of the difficult terrain of the Himalayas, and the social and political situation in Nepal. They are followed by Budgetary/Financial, Political/Governance, Coordination/Stakeholder, Design/Data/Feasibility and Environmental/Regulatory risks.

The table shows that there are strong links between the risks, such as that inadequate geotechnical data leads to land acquisition delays and cost overruns, and coordination failures are exacerbated by political interference. This is the reason why many problems

are only apparent when construction is carried out, but it has its origins in the planning stage.

In general, the participants depicted these risks as being very interdependent. For instance, poor geotechnical data can worsen land acquisition issues and cause cost overruns, and political involvement can add to coordination issues. The risks are not just technical, rather they are intrinsically part of the institutional and socio-political environment of Nepal. From his construction experience, as P08 summarised, many of these problems stem from planning but only become apparent as delays, cost-overruns and public discontent. The following sections discuss the practical process of risk identification, analysis and mitigation.

4.2 Risk Identification Practices

Risk identification in the planning phase of road infrastructure projects in Nepal was found to be mostly informal, experience-based and pragmatic, with no well-established formal tools or frameworks for risk identification in the country. This was true for all twelve interviews irrespective of organisation and years of experience. Feasibility studies and Detailed Project Reports (DPRs) were often cited as formal starting points but a large number of risk identification activities were carried out using site-based activities, stakeholder consultations, reference to previous project, and expert judgment. Rarely, structured tools for identifying risks were employed, like risk registers, checklists or dedicated risk identification workshops. A few participants mentioned using supplementary tools like SWOT or PESTLE analysis at the odd times, but these were not institutionalized.

The most commonly mentioned methods were field surveys or reconnaissance visits. P01 highlighted *"Field surveys and reconnaissance"* as a key approach and found it necessary to get a firsthand impression of the remote hilly area. Similarly, P10 responded, *"We usually do site visits and talk to local people to understand the area."* P07 noted the need for topographic surveys, soil tests, hydrological studies, and involvement with the community, especially in the flood-prone Terai areas, as communities frequently identified risks that were not evident in the initial desk-based

surveys. P03 also identified the following as standard practice: *"Geotechnical investigation of vulnerable spot, geological study, hydrological and environment study."*

The feasibility study and the process of preparing a DPR were well-known, but participants often described their effectiveness in a qualified way. P01 mentioned *"Feasibility studies and DPR (Detailed Project Report)"* as one of the key methods, while a number of other methods have been mentioned with limitations. P02 condemned the process for the lack of time and budgetary resources and for doing *"rough technical and environmental assessments".* P06 referred to *"Contract document study, analysis and review"* and *"Environmental Screening like IEE and EIA,"* which in some cases provided a de facto risk identification process. Participants noted repeatedly however, that DPRs were also frequently derived from incomplete or outdated information, especially in hard to reach areas, which decreases the reliability of the DPRs for early detection of risk.

It was stated that stakeholder consultation particularly for local communities, ward offices and affected people was vital but not always carried out. P01 emphasized *"Local communities, ward offices consultation"* as a key way. P07 described the stakeholder engagement with the local communities and municipalities, which helped identify the seasonal flooding risks that were not identified in the initial surveys. P12 emphasized the need to seek the views and opinions of local stakeholders on the ground realities, including land disputes or flood history. In addition to historical data and expert judgment, P05 added *"Stakeholders' consultation".* P08 stated that land access, environmental and social risks were identified through public consultations, which involved local communities.

Past projects review and expert judgement were considered the most practical and common methods. The following methods were identified as essential in P01 explicitly listed *"Review of past similar projects"* and *"Expert judgment & ideas (Engineers, geologists)."* P02 mentioned *"Historical records and data base"* along with geotechnical assessment. P06 mentioned *"by collecting feedbacks from similar projects"* and *"Road safety audits."* Expert judgment was given great weight when good data was not available. P04 and P10 both indicated that they relied heavily on *"expert judgment from*

senior engineers" and P03 indicated that there was an additional *"Safety audit"* layer of expert review.

Also, it was evident that the key stakeholders in risk identification were identified by the participants. Most frequently mentioned were the Department of Roads (DoR), consultants, local governments, contractors, affected communities, and environmental agencies. P01 gave a complete list: *"Department of Roads, Consultants (design & feasibility experts), Local governments (Municipality/Rural Municipality), Contractors, Affected local people, Environmental Agencies / Experts."* P03 included *"Governing office representative, consultant, concern local people"* and P05 included *"Public officials, Local bodies, Public, Donors".* P06 identified DoR, consultants, local governments, user groups, and donors. P08 noted that the client (government authority), consultant, contractor and local community all played a part, offering varied views on political, technical and social risks.

However, regardless of the array of techniques and actors, an overwhelming majority of the participants described risk identification as reactive, disjointed and reliant on individual experience as opposed to proactive and systematic. P08 noted that risk identification processes in Nepal's road projects were *"largely informal and experience-based"* with senior engineers depending much on their experience. P09 commented that *"the use of structured tools such as a risk register or checklist is still limited"* and most processes were individual based. In a similar vein, P11 said that the process of defining risk was based on *"site visits, past project experience and discussions with senior engineers"* and that at times, feasibility studies were not sufficiently detailed. A small proportion of participants said they have formal frameworks in place, and these frameworks were described as being limited or as part of an individual project.

Table 5. Common Risk Identification Practices in the Planning Phase

Method	Description / Examples	Limitations
Field surveys & reconnaissance	Site visits, topographic & geotechnical surveys	Time-consuming, dependent on accessibility
Feasibility studies & DPR	Initial project reports and desk studies	Often based on incomplete/outdated data
Stakeholder consultation	Local communities, ward offices, affected people	Not always conducted systematically
Review of past similar projects	Lessons learned from previous road projects	Limited documentation of historical data
Expert judgment	Senior engineers, geologists, and consultants	Subjective and inconsistent across teams

The stakeholders identified as key players in risk identification were the Department of Roads (DoR), consultants, local governments, contractors, affected communities and environmental agencies. But there was a frequent lack of collaboration among these stakeholders, resulting in disjointed and reactive identification efforts.

Risk identification carried out in Nepal's road industry is not documented and is largely based on personal experience. A reactive approach reduces the chances of identifying strategic risks at an early stage and adds to the long-term implementation issues in projects like Narayanghat-Butwal. These results directly answer the second supporting research question and suggest that there is a definite gap between international standards (ISO 31000 and PMBOK) and practice.

In general, these results suggest that there are many techniques to identify risk but in practice, risk identification is informal, experience-based and ad hoc. The issue with this approach is that it's based on experience and there are tremendous inconsistencies and a lack of documentation and early detection of strategic risks. These patterns create the foundation for the next step of analysis, prioritisation and mitigation of identified risks, as described in the following sections.

4.3 Risk Analysis & Evaluation Practices

Thematic analysis of the 12 semi-structured interviews revealed that risk analysis and evaluation done during the planning phase of Nepalese road infrastructure projects are

widely qualitative, subjective and expert judgement dependent, with no standardised framework or formal quantitative methods used. The participants invariably referred to a process based on experience, informal discussions and basic ranking mechanisms like risk matrices. This is useful in a low resource and data deficient setting for making rapid decisions, but it also causes inconsistencies, inadequate record keeping, and less ability to predict future strategic risks. The results reveal that there is a distinct gap between the formal risk analysis processes described in international standards like ISO 31000 and what practitioners experience in practice in federal, local government, consultancy and contracting organisations.

Nearly all the respondents noted that the qualitative method is predominant and frequently used in Nepalese context. P01 explained in detail: *"Qualitative Analysis (most common in Nepal) • Risk matrix (low, medium, high) • Expert judgment. Quantitative Analysis (limited use) • Cost estimation models • Sensitivity analysis."* This preference for qualitative methods was echoed strongly by P09, who said: *"Risks are mostly analyzed using qualitative approaches such as expert judgment and risk matrices. Quantitative techniques are rarely used due to lack of data and technical capacity. The likelihood and impact of risks are assessed subjectively. This can sometimes lead to inconsistent evaluations."* In a similar way, P07 said *"In the Terai region, risk analysis is mostly qualitative. Risk matrix (low/medium/high), Expert judgment, Flood risk mapping, Scenario analysis. For example, flood-prone areas are classified into risk levels based on past flood data and water flow patterns."*

P08 gave one of the most comprehensive descriptions of how analysis really takes place in practice: *"In my experience, risk analysis was primarily qualitative. Risks were subjectively ranked based on past experience and expert judgment. They were often categorized as high, medium, or low in terms of probability and impact, though this was rarely documented formally. Most analysis occurred through meetings and discussions where risks were verbally prioritized. Quantitative analysis techniques such as Monte Carlo simulation or decision trees were not used due to limited technical resources, time constraints, and lack of familiarity with such methods."* The need to prioritise verbally and through meetings, instead of using documented tools, was a common trend. P10

confirmed this: *"Mostly we use qualitative methods. We rate each risk as high, medium, or low based on how likely it is and how much damage it can cause. We do not use complex quantitative tools on most projects. It is mostly based on the experience and judgment of the senior engineers."*

In all the interviews, expert judgment emerged as the key analytical process. The technique was described very simply and clearly by P04: *"Analysis Techniques: Primarily qualitative analysis based on experience and impact severity (High, Medium, Low)."* P05 added: *"Likelihood of occurrence and its impacts, Expert judgment."* P02 referred to slightly more general tools, but still based on judgment, such as *"Direct judgement, Experienced expert opinion, Sensitivity analysis, Statistical analysis and regression analysis."* Where the participants mentioned semi-quantitative tools like probability analysis or sensitivity analysis (P06), they were mentioned as supporting expert opinion but not as rigorous methods in their own right.

There was generally good consensus among participants when it came to key factors used to determine which risks to tackle, with safety always being a top priority. P08 explained in detail: *"Based on my observation, safety risks were always given the highest priority. Risks of accidents during girder launching, pile construction, or work at heights were addressed immediately without compromise. Schedule risks, particularly delays affecting project completion dates such as those caused by monsoon rains, were given the next highest priority. Cost risks, including material price escalation and unexpected foundation work, were considered medium priority. Stakeholder impact risks such as community disputes or political interference were sometimes given lower priority initially, though these could escalate quickly if ignored and then become the highest priority."* P07 agreed with this hierarchy: *"Risks are prioritized based on: Safety (highest priority), Cost impact, Time delay, Environmental and social impact, Flood risk severity. For example, flood damage risk is prioritized over minor cost issues because it affects road usability and safety."* The Top 3 risk factors identified by P01 were: *"Time delays, Cost overruns, Safety concerns."* P12 emphasised practical results: *"Risks are prioritised based on the effect on the construction time and safety, particularly the challenging topography of Karnali region."*

In most instances the use of formal risk analysis frameworks and tools were reported as very limited or not at all. P08 was very clear: *"No, formal frameworks such as ISO 31000 or PMI risk management processes were not used in the projects where I worked. Risk management was conducted informally, relying on the experience of senior engineers, daily site observations, and weekly progress meetings. There was no dedicated risk register, risk management software, or structured risk analysis framework applied consistently across projects."* P09 confirmed: *"Formal frameworks like ISO 31000 or Project Management Institute guidelines are not widely implemented in practice. Some large projects may adopt them partially, especially with international support. However, most local projects rely on informal practices."* P03 provided the response of *"No exact tools are used"*, and P02 provided the response of *"Currently no".* There were very few references to formal guidance (only national documents). P01 indicated: *"Yes, we use Department of Road Norms 2070 BS, Nepal Rural Road Standard 2071 BS."* Both P04 and P12 mentioned *"Standard Bidding Documents and DoR guidelines",* but then both stated that "international standards" like ISO 31000 are *"rarely used strictly".*

Participants cited a number of practical challenges that hinder deeper analysis. P09 highlighted *"lack of reliable data for accurate analysis, limited technical expertise and absence of standardized tools"* as well as *"external factors like political instability."* P11 noted that *"sometimes they are not detailed enough."* Most analysis is still not documented and is verbal, said P08: *"Most analysis occurred through meetings and discussions where risks were verbally prioritised."* All these factors lead to a pragmatic and rapid, but less traceable, repeatable and efficient evaluation process, which fails to consider strategic or long-term risks effectively.

Table 6. Risk Analysis and Evaluation Practices in the Planning Phase

Analysis Approach	Key Techniques Used	Major Limitations
Qualitative Analysis	Risk matrix (low/medium/high), subjective ranking	Highly subjective and inconsistent
Expert Judgment	Experience of senior engineers	Dependent on individuals, limited documentation
Risk Matrix	Probability-impact matrix	Rarely formally recorded
Quantitative Analysis	Sensitivity analysis, basic cost models	Very limited due to data scarcity and technical capacity
Formal Frameworks (ISO 31000 / PMBOK)	Almost none	Not institutionalised in most projects

It can be seen in Figure 6 that the risk analysis and evaluation practices performed during planning are predominately qualitative and informal. 100% (12) of the participants use Qualitative Analysis and Expert Judgment. 9 participants (75%) use a simple Risk Matrix, Quantitative Analysis and Formal Frameworks (ISO 31000 or PMBOK) are almost never used (only 1/12 respectively). This is an indication of the significant predominance of subjective and experience-based approaches over structured or data-based approaches in the case of road projects in Nepal.

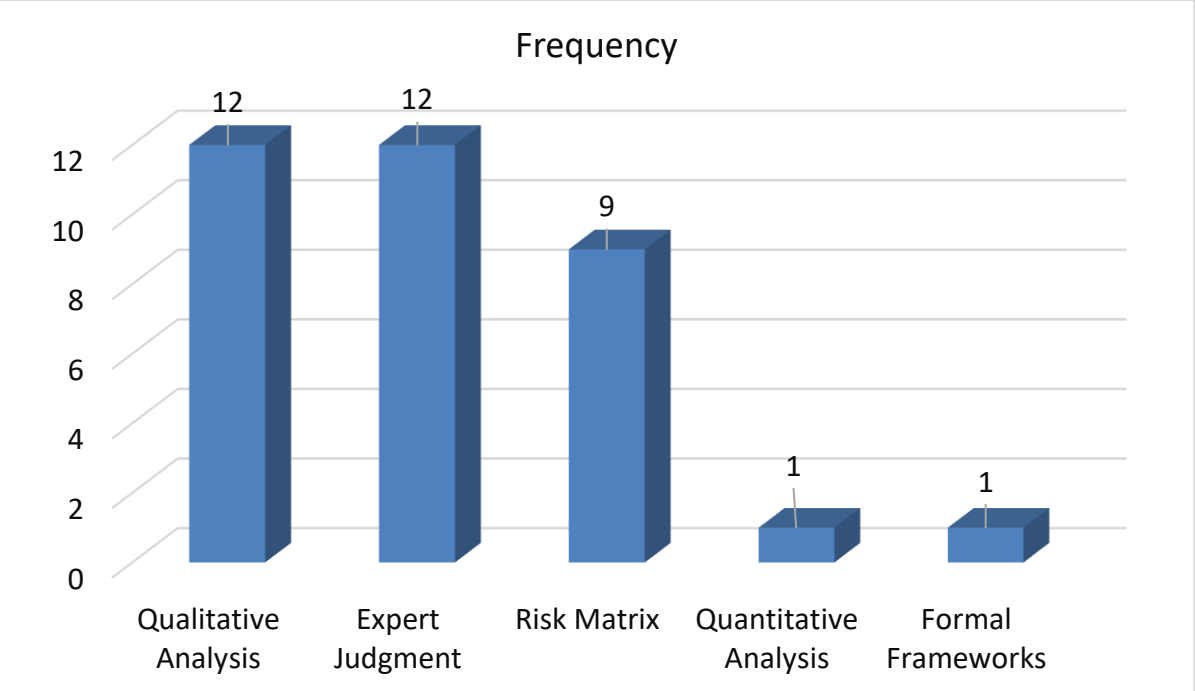

Figure 6. Risk Analysis and Evaluation Methods Reported by Participants

To sum up, practices in risk analysis and risk evaluation in the planning phase are predominantly qualitative, rely greatly on expert judgements, use very basic risk matrices, have little quantitative risk analysis and have almost no formal international frameworks. It is appropriate in the context of Nepal where decisions are made on an experiential basis but it also has its strong drawbacks in terms of consistency, documentation and foresight. These evaluation practices have direct impact on the subsequent mitigation practices which are discussed below.

4.4 Risk Mitigation Strategies

The risk mitigation strategies, which are implemented during the planning phase, were found to be practical and experience-based, but generally informal and reactive instead of systematic, and proactive. Mitigation measures in the twelve interviews were grouped into four categories: technical solutions, administrative options, financial planning and environmental compliance. These strategies were well known and used, but were constrained by lack of consistency, limited resources and poor coordination. The results show that engineering judgement and consultation with stakeholders is of paramount importance when making mitigation decisions, while the use of formal methods like detailed cost-benefit analyses or risk registers is relatively rare. Further examples of inadequate mitigation highlighted the need to be mindful of downstream impacts as a result of the lack of planning.

Technical solution was the most commonly mentioned type of mitigation. Participants pointed out physical measures to combat geotechnical and topographical risks. Common strategies are: *"Technical solutions ◦ Slope stabilization, retaining walls ◦ Proper drainage design,"* P01 explained. P07 emphasised the same in the Terai context which are: *"Raised road embankments, Proper drainage systems (culverts, canals), River protection works (gabion walls, embankments)"* and alternative alignment to avoid flood zones. P08 noted performing more site investigations prior to critical work (such as piling and pier foundation) as well as planning for multiple soil conditions. With weather-related risks, critical activities were planned during the dry season and materials stockpiled ahead of time. Both P04 and P12 made comments about changing the design,

including the retention of the retaining walls for slope stability. These technical approaches were seen as key to mitigating the more prevalent geotechnical and climate risks which were identified in the themes above but, again, a number of people pointed out that these measures are often put in place after the fact.

Relevance to administration and stakeholders was on early engagement and process improvement. Several participants mentioned the importance of land acquisition in the early stage. P01 indicated that one of the standard approaches is *"Administrative measures ◦ Early land acquisition process"* P05 recommended the following: *"Contract agreement only after completion of all required preparations like land acquisitions"* and *"Consultation with the local authority, public and other stakeholders."* P06 also called for *"Pre land acquisition and forest clearing"*, and *"Coordination different stakeholders".* P09 pointed out that *"stakeholder consultation"* is an integral part of mitigation and P10 mentioned initiating the land acquisition process early with the involvement of local leaders and community members. P07 emphasized that one of the important measures to be taken in flood prone areas is *"Community engagement".* These administrative measures aimed at minimizing social and land-based risks were recognized by participants as having potential to be effective, although there was a realization that delays in execution may negate the impact.

Contingency budgeting and price adjustments were the bases for financial planning strategies. P01 specifically mentioned the following: *"Financial planning 1.Contingency budgeting."* P07 introduced *"Contingency budgeting"* as part of its normal routine. P09 explained *"contingency budgeting"* in addition to any contractual provisions to allocate any risks between parties. P06 mentioned *"Provision of contingencies and price adjustments."* These financial instruments were identified as essential to cope with budgetary uncertainty or cost escalations, and several of the participants noted that contingency funds are sometimes not adequate or not dedicated to specific contingencies.

There was a close connection between environmental management strategies and compliance with regulations. P01 was about *"Environmental management ◦ EIA compliance and mitigation plans."* One of the key points highlighted by P05 was the

"Environmental study of the project including Environment Management Action Plan and their proper execution". P06 emphasised the *"Green road concept"* and *"Adoption of social and environmental measures for impact mitigation as recommended by experts".* These steps were considered critical to solve the problem of delay in environmental clearance and long-term environmental issues especially in donor funded or in sensitive hilly projects.

Decisions regarding mitigation were typically determined by engineering feasibility, consultation with stakeholders and minimal cost-benefit analysis. P01 explained that decisions are based on *"Cost-benefit analysis, Engineering feasibility, Stakeholder consultation, Government policies and guidelines."* P08 noted that *"mitigation decisions were made through consultation between the site engineer and the project manager… Major decisions… required approval from the consultant or client through stakeholder agreement. Formal cost-benefit analysis was rarely conducted."* Decisions are made on *"usually based on cost-benefit analysis and expert judgment"* P09 said, but political and administrative pressure can influence the decision. Both P05 and P06 highlighted stakeholder consultation and technical committees as key decision making fora. Overall, the process was said to be collaborative but hierarchical, with ultimate signoffs sometimes being with higher level government or with clients.

The participants described concrete examples of how risks were not mitigated well enough and the real-life impact of planning stage gaps. P01 presented a very clear case: *"Risk: Landslide-prone area ignored during planning. Issue: No proper slope protection design. Consequences: Road blockage during monsoon, Increased maintenance cost, Project delays, Public dissatisfaction."* One particular case outlined by P08 was a bridge approach road utilizing RE Wall technology, where *"the risk of monsoon-triggered erosion… was identified but was not fully mitigated because the planned erosion control measures… were delayed due to material shortages."* This resulted in rework, 15 to 20 percent over costs, two to three week delay and greater safety risks. P09 mentioned a project that had an issue of *"insufficient geotechnical investigation led to slope instability during construction. This caused delays and increased costs significantly."* P06 mentioned widening of the Karnali Highway (KKH) due to the impact of COVID-19 and

lack of studies on slope protection made the project more costly and delayed. In these examples failure in early mitigation consistently resulted in time overruns, cost escalations, safety problems and public discontent.

Table 4.4 shows that risk mitigation in the planning phase of Nepal's road infrastructure projects is still very reactive and informal. The engineering and technical solutions predominate (11/12 participants) and the most common solutions are slope protection, retaining walls, bio-engineering and drainage. Stakeholder engagement and negotiation (10/12) and budget reallocation (8/12) also have a high score, indicating the socio-political and financial conditions of the sector.

Table 7. Risk Mitigation Strategies Reported by Participants

Mitigation Strategy	Frequency	Key Examples	Limitations
Engineering and Technical Solutions	11	Slope protection, retaining walls, bio-engineering, drainage	Costly and often implemented late
Stakeholder Engagement & Negotiation	10	Compensation to landowners, community meetings	Time-consuming, affected by political pressure
Design Modifications	7	Alignment changes, additional geotechnical surveys	Causes delays in DPR approval
Budget Reallocation & Additional Funding	8	Supplementary budget requests	Depends on government approval
Political & Community Lobbying	7	Engaging local leaders and politicians	Unsustainable and may raise ethical concerns
Formal Risk Treatment Plans	2	Insurance or contractual clauses	Almost never institutionalised

But the table shows areas of vulnerability. Design modifications (7/12) frequently result in delays in DPR approval and political/community lobbying (7/12) is commonly used but considered not viable. Most importantly, very few formal risk treatment plans (only 2/12) almost exist, which confirms the almost complete lack of systematic approaches in line with ISO 31000 or PMBOK.

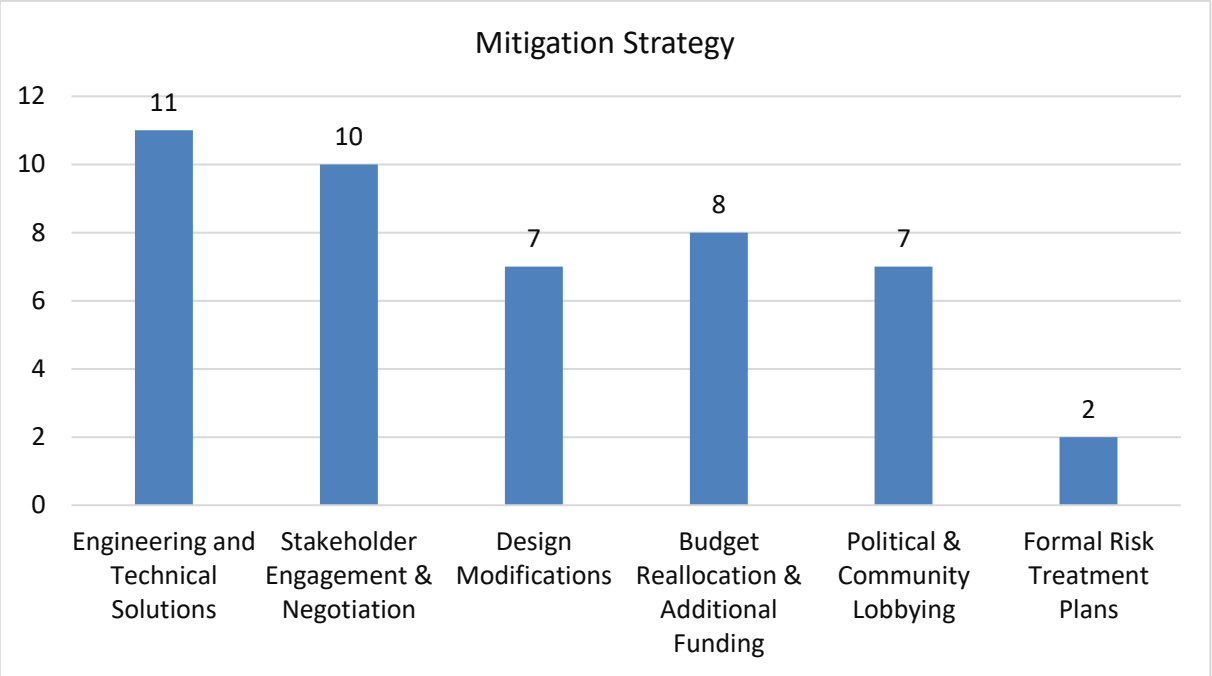

Figure 7. Mitigation Strategy

These results indicate that mitigation efforts are dependent on the individual's skill and are often improvised engineering solutions and do not necessarily follow a documented plan. Reactive pattern has direct impact on chronic cost and time overruns which is why the conceptual model of the study related to gap between formal standards and actual professional practice in Nepal road sector is valid.

Even though the different strategies described, there were important limitations pointed out by the participants with respect to the current practice. Often mitigation was reactive—that is, it was not implemented until the risks were identified in the later phases. There was lack of mitigation plan documentation and accountability was low. Some participants, such as P08 and P09, made recommendations to increase the formal nature of mitigation, for instance, risk registers and structured stakeholder workshops to make it more proactive and consistent.

Risk mitigation measures during the planning stage are a mixture of technically, administratively, financially and environmentally orientated mitigation measures, which are based on hands-on engineering experience. But their use is mostly informal, infrequently applied and reactive. Participants showed a good understanding of what to do in the face of risks faced by projects but systematic frameworks and thorough early

planning are often not in place that can help prevent unnecessary project impacts. This provides the context for looking at governance and coordination challenges in the next section, which have been influenced by the analysis and evaluation processes outlined above.

4.5 Governance and Coordination Challenges

Governance and stakeholder coordination emerged as one of the most important but challenging issues in risk management in the planning phase, and were consistently identified as such at all the events. There were formal arrangements for coordination at federal, provincial and local levels of government, but in practice coordination is considered to be fragmented, reactive and often hindered by institutional, political and resource issues. The 12 interviewees emphasized the need for synergy between various stakeholders for effective risk management, but with limited synergy in the road infrastructure sector in Nepal, delays, duplication of effort and lack of addressing risks are the outcome. Such governance issues were not considered to be stand alone, but systemic risk factors that intensify the technical and financial risks mentioned in the previous sections.

Typically, there is coordination between the planning stage that is both formal and informal. According to P01, *"Only federal, Province & Local Level are coordinating in our regions."* P03 put it as simple as: *"By mutual coordination between different stakeholders."* P05 added more detail saying that coordination occurs via *"Frequent meetings, Sharing of reports and required data, Correspondence."* The picture from the contractor side was richer at P08, with regular progress meetings with client, consultant and contractor representatives, written communication, site visits and informal day to day communication between engineers. P10 provided some detail to explain that project engineers, consultant teams, local government offices and community representatives all work together with the Department of Roads engaged in larger projects. P06 added that there are committees comprising national planning bodies and the Ministry of Physical Infrastructure and Transport for inspection and progress review, as well as joint surveys, public hearing and compensation processes by contractors,

consultants and clients. The mechanisms were mentioned by P07 to include inter-agency meetings, public consultations, project committees, and review meetings of donors.

Nevertheless, a participant's description of coordination was generally one of a lack and inefficiency. Common issues mentioned were lack of communication, competing priorities, unclear roles and red tape. P11 identified *"Poor Communication"* and *"Multiple layers of Approval"* which delays the process. *"hierarchical decision-making"* is described by P08 as having a significant impact on delays, as well as *"information silos"* between client, consultant, and contractor, and *"limited authority of the site engineer"*, where minor decisions can be made on-site with greater risk responses needing head-office approval. Conflicting priorities were mentioned repeatedly: *"the client prioritizes cost, the contractor prioritizes schedule, and the consultant prioritizes quality, and these priorities are rarely aligned."* P08 said. P09 also highlighted that the *"unclear roles, lack of communication, and institutional overlap,"* along with *"bureaucratic delays"* and *"conflicting interests among stakeholders"* were all perceived as a barrier to progress.

Coordination challenges were also exacerbated by resource and data-related issues. P03 listed the "*Lack of sufficient data, limited time and cost constraints.*" The following was identified as a problem in P05: *"Large number of associated agencies, Poor historical data, Limited resources and capacity of technical staff."* P06 mentioned *"Lack of proper planning, Lack of information, Lack of resources (Human, Tools)."* P11 also reported that sometimes feasibility studies are *"not detailed enough"* and P07 stated *'weak communication'* and *"overlapping responsibilities"*. These challenges were particularly severe among the remote hilly districts as P04 indicated *"Communication gaps due to remote locations"* and P01 mentioned *"budgeting, topography & environmental Issues (EIA, IEE etc)."*

Political and regulatory uncertainty has proven to be a key factor of disruption. The interviewees explained how the frequent changes of government, changes in policies and local political disputes directly impact on risk management. P01 said that *"Local level is about political issues and political instability and this comes on tendering process and many more stages on designing and constructing."* P03 said that *"Mainly political*

instability effect on planning because government action must be taken in short period and result must be within short period." P05 indicated *"Internal conflicts within the country, Price hikes through inflation, Poor financial management."* P08 gave a detailed description: *"Frequent changes in government lead to changes in project priorities and funding release schedules. Regulatory uncertainty regarding environmental and land acquisition approvals can cause unexpected delays. Political interference in contractor selection or resource allocation creates uncertainty… Strikes and bandhs disrupt material transport… Local political pressure for hiring local labor or using local suppliers affects project decisions."* The delays of the continuity of projects were reported by P12, who said that *"Frequent change of local leadership and shifting budget priorities often delay the continuity of projects"* and P07 who stated that *"Political interference and shifting priorities remain a risk for Terai projects".*

Such governance and coordination issues were not only operationally inconvenient but also directly impacted the entire risk management process. Participants noted that risks identified during planning are not always communicated and/or acted upon between agencies, resulting in a reactive response. P08 commented on *"many issues only emerging during construction that should have been addressed during the planning stage."* P09 pointed out that *"communication gaps often occur between stakeholders*" which hinders timely decision making. Overall, the picture described by interviewees was that the governance framework is quite complex but the operational capacity is weak, with overlapping functions, low levels of accountability and lack of arrangements for shared risk.

Some respondents shared examples of more successful inter-agency coordination in certain situations. P06 felt joint surveys and public hearings with a variety of stakeholders were helpful, and P07 publicised donor review meetings for larger projects, which added structure. But these were examples of the exception and not the rule, especially at smaller local level or non-donor financed projects.

Summarizing, the governance and coordination during the planning phase is characterised by a number of systemic weaknesses such as fragmented institutional structures, insufficient information sharing, conflicting stakeholder agendas and high

levels of political interference. There are basic coordination mechanisms but they lack resources, have implementation problems and political instability. This set of challenges makes it difficult for project teams to convert risk identification and risk analysis to active, timely and consistent risk mitigation measures. The following section looks at the participants' evaluation of the overall effectiveness of the current risk management practices and what they felt needed to be done to improve them.

4.6 Effectiveness of Current Risk Management Practices

The 12 interviews were thematically analyzed, and the result indicated that the current approach of the risk management in planning stage of the road infrastructure projects in Nepal is found as moderately effective. Basic risks are usually known and dealt with to some degree, but the whole process is seen as reactive, informal and inadequate to respond to long-term or complex risks. It has some strengths such as experience and a focus on the tangible and immediate threat, but its reliability is called into question by serious weaknesses in implementation, the use of formal tools, documentation and coordination. These were all noted by the federal, local, consultancy and contractor viewpoints and suggest that the shortcomings are not just stakeholder based.

Most participants said the current system is at best, moderate. P01 explicitly stated, "*Moderately effective but weak in implementation.*" This was echoed by P05 who stated: *"Effective in medium way. It cannot predict the future risks, it is reactive rather than proactive."* P04 had a similar nuanced perspective: *"Moderately effective; while basic risks are managed, we lack advanced predictive tools for long-term climate and disaster risks."* P09 gave more detail on the limitations: *"The current risk management system is moderately effective but has significant limitations. It is mostly reactive rather than proactive. Lack of standardization reduces its efficiency."* One of the most comprehensive evaluations was undertaken by P08: *"the current risk management process is moderately effective for immediate and visible risks but weak for strategic and long-term risks… Overall, the process is informal, experience-driven, and reactive rather than structured, proactive, and strategic."*

A number of participants commented that effectiveness is likely greater when it comes to safety and short-term operational risk and becomes less when it comes to strategic and emerging risks. P07 noted a *"Mostly reactive approach, Limited use of advanced tools, Weak monitoring system, Moderate to low effectiveness.*" P12 said basic risks are well managed, but there is a clear gap to address long-term risks like climate and disaster risks. P03 highlighted the need for increased planning time and more consideration of multiple stakeholder issues in linear projects, suggesting that this is not currently being done to a satisfactory level. The more positive were qualified. P06 acknowledged some progress: *"The management process in Nepal's road infrastructure development is more effective as it have reduced the risks, the practice is being planned controlling of negative impacts and problems. It also has fulfilled the gap between the stakeholders involved in the projects."* But it was not expressed in absolute strength; it was stated as a relative improvement.

One of the consistent comments was that the entire process was reactive. The participants kept on comparing present practices with proactive and structured approach suggested by International standards. P05 stated outright that the system is not able to predict the future risks. P08 supported this by pointing out that there is a high level of effectiveness in safety risk management, but geotechnical, financial and political risk management is low, because of limited site investigations, lack of control over payments and no structured assessment. One of the areas that P09 pointed out as a gap is *"insufficient focus on early risk identification".* P02 expressed a more general concern: *"Currently unaware due lack of data, but seems not positive."* It is these comments that show that system problems can be dealt with on the basis of experience, and by making adjustments on the spot, but it is much more difficult for the system to forecast and avoid dangers during the planning process itself.

Also participants found structural and institutional weaknesses that decrease the overall effectiveness. Lack of standardisation and formal tools was a common theme. P09 commented that frameworks like ISO 31000 are not widely used. P08 noted that there was *"no dedicated risk register, risk management software, or structured risk analysis framework applied consistently across projects."* P07 reported weak monitoring and

follow up mechanisms and P01 referenced *"weak in implementation."* Data limitations further hampered effectiveness. P05 and P11 both suggested that there is a lack of historical information and that the feasibility studies are not completed, which affect planning. Coordination failures, already mentioned in the previous section, were constantly associated with diminished effectiveness. P03 emphasized that *"In linear project multiple stakeholders individual concern must be addressed"* and P08 mentioned that conflicting priority of the stakeholders is not well aligned.

While these limitations were acknowledged, there were also some positive aspects recognised by the participants. Professionals in familiar situations can manage known risks well, using experience-based decision making. P06 noted that in some projects, the involvement of stakeholders and the reduction of risks have been improved. P08 admitted that safety management is *"highly effective due to strong regulatory requirements and moral imperative."* Moderate level of practical knowledge, weather and delay risks are moderately well handled. It was, however, a set of strengths presented as partial successes in an otherwise underdeveloped system.

Table 8. Major Challenges in Risk Management Practices Reported by Participants

Challenge Category	Frequency	Key Examples	Impact on Projects
Lack of Formalized Frameworks	11	No use of ISO 31000 or PMBOK risk registers	Reactive rather than proactive management
Weak Inter-Agency Coordination	10	Poor linkage between DoR, local governments, consultants	Delays in decision-making and approvals
Limited Data & Technical Capacity	8	Outdated surveys, insufficient geotechnical data	Inaccurate DPRs and frequent design changes
Political Interference & Governance Issues	6	Frequent policy changes, political pressure	Scope creep and unrealistic timelines
Resource Constraints (Budget & Time)	5	Insufficient funding for detailed studies	Skipped risk identification steps
Inadequate Stakeholder Involvement	3	Limited community consultation	Land acquisition delays and conflicts

Table 4.6 identifies the systemic issues that affect effective risk management during the planning process in road infrastructure projects in Nepal, as expressed by the 12 participants. The vast majority (11/12) indicated that the lack of the formalized framework (e.g., ISO 31000 or PMBOK risk registers) were the biggest issue, and most practices are reactive. Weak inter-agency coordination (10/12) is closely related, and is a result of poor inter-agency linkages between the Department of Roads, local governments and external consultants, which frequently delay decision-making and approvals.

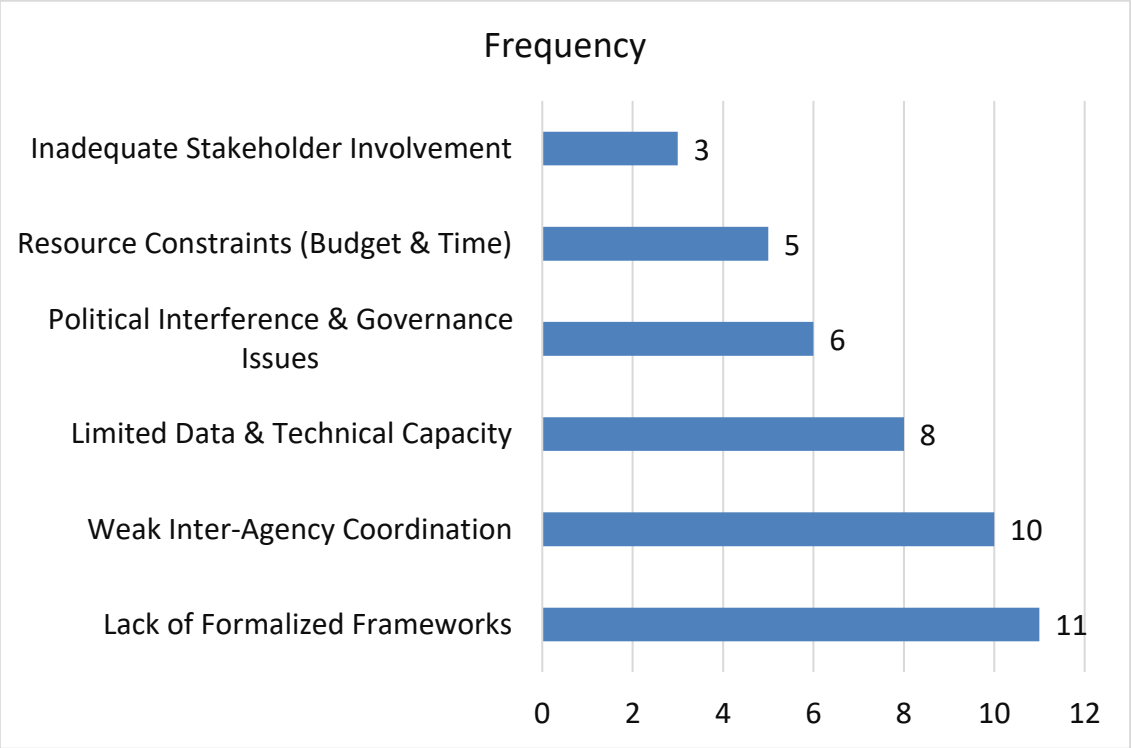

Figure 8. Major Challenges in Risk Management Practices Reported by Participants

The problem is compounded by limited data and technical capacity (8/12) that results in outdated surveys, limited geotechnical data and inaccurate Detailed Project Reports (DPRs) and frequent design changes. Political interference and governance issues (6/12); lack of resources (5/12); and lack of stakeholder involvement (3/12) were also identified, all of which led to scope creep, unrealistic timelines, missing risk identification steps, and land acquisition issues.

The results of this study provide good support for the conceptual framework, showing the relationships between institutional and governance weaknesses (inputs) and risk management practice (processes) to the project outcomes.

Overall, the participants characterised the current risk management process in the road infrastructure planning phase in Nepal as moderately successful in dealing with apparent and immediate risks, based on experience and simple measures, but inherently constrained by reactive risk management, lack of standardisation, limited data and tools, and poor institutional coordination. Although there are some improvements in certain aspects like safety and consultation with stakeholders, the system is still not proactive and structured, as it should be in large-scale infrastructure development. These limitations in effectiveness are relevant to the recommendations provided by the participants, and this is explored in the next section.

4.7 Recommendations

The participants provided concrete and tangible suggestions on how to improve risk management in the planning of roads in Nepal. Their recommendations were centred on a more systematic, proactive and institutionalised approach, instead of the current informal, reactive process.

The most common suggestion was the use of formal risk management processes. P01 urged to *"Adopt systematic risk management frameworks"* and *"Introduce risk registers in all projects."* P08 strongly recommended the development of formal risk registers, risk workshops with all stakeholders in structured format and training to ISO 31000 or PMI concepts. P09 also highlighted the need for embedding risk management in the initial planning phases and harmonization of international standards such as ISO 31000.

Another strong theme was around improving data quality and feasibility studies. P01 highlighted the importance of *"Improve data collection and feasibility studies".* P02 reiterated that *"The planning must be rigorous, multi sectoral, must be based on facts and data."* Both P07 and P12 emphasized the need for thorough flood, soil, and geotechnical studies in the planning phase and the adoption of advanced technologies like GIS and digital monitoring systems.

Inter-agency coordination and early engagement of stakeholders were also a strong theme. The P01 recommendations were: *"Strengthen inter-agency coordination"* and *"Ensure early land acquisition and stakeholder engagement."* P06 and P09 emphasized the need for improving co-ordination mechanisms and for undertaking public consultation in order to mitigate social risks and land-related risks.

Participants also recommended the greater use of technology and capacity building. P01 recommended *"Increase use of technology (GIS)"* and training of engineers and planners. P08 recommended the incorporation of BIM for risk visualisation, and the provision of dedicated contingency budget for geotechnical risks. P05 suggested the institutionalization of the front-end risk assessment and quantitative risk assessment methods.

The 12 participants provided concrete and viable suggestions for improving risk management aspects during the planning process of road infrastructure projects in Nepal. Their recommendations all highlight a need to change the existing informal, reactive, experience-based system to a more systematic, proactive and institutionalised one.

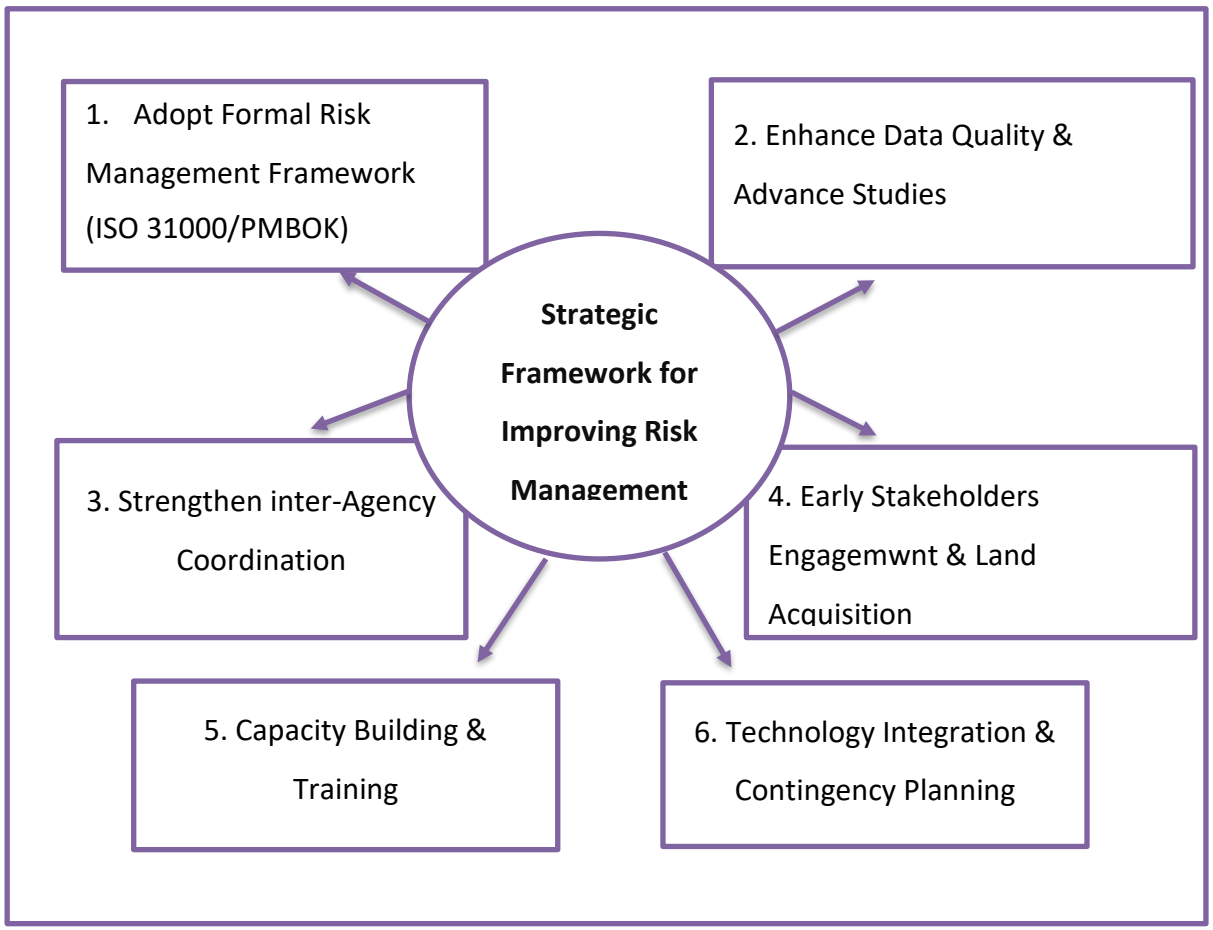

Figure 9. Recommended Strategic Framework for Improving Risk Management

The most prominent suggestion was implementing formal risk management structures. There was strong consensus that there is a need to combine the principles of ISO 31000 and PMBOK, such as using risk registers, structured risk workshops and systematic risk assessment from the feasibility stage (P01, P08, P09).

Another key theme was data quality enhancement and feasibility studies. Participants recommended the use of comprehensive geotechnical, hydrological and environmental investigations for rigorous, multi-sectoral planning; and increased use of GIS and digital tools (P01, P02, P07, P12).

Improved coordination and early engagement of inter-agency actors was a key priority. Suggested solutions were to provide clear coordination processes between federal, provincial and local levels and to undertake meaningful consultations with the public in the early planning stages to minimise land acquisition conflicts (P01, P06, P09).

Capacity building and integration of technology were also highlighted by the participants. Proposals raised were the need for mandatory training in International Risk Standards, use of Building Information Modelling (BIM) and dedicated contingency budgets for identified risks (P05, P08).

In general, the participants expressed a call for a paradigm change towards pro-active, evidence-based and institutionally-supported risk management. The adoption of these suggestions would make a great contribution in minimizing the cost overrun, delays and disputes in Nepal's road infrastructure industry.

CHAPTER 5: DISCUSSIONS AND CONCLUSIONS

5.1 Comparative Study of Risk Management Practices in Road Infrastructure Projects

The results of the 12 semi-structured interviews indicate that there is a huge gap between the idealised practices as prescribed internationally and what is actually done during planning of road infrastructure projects in Nepal. This section compares empirical findings with international frameworks (ISO 31000:2018 and the PMBOK Guide), explores the findings in relation to the megaproject paradox and behavioural explanations, and analyse the findings in the context of institutional and governance issues in developing country contexts and how the study contributes to the conceptual framework presented in Chapter 2.

5.1.1 Linking Findings with International Risk Management Standards (ISO 31000:2018 and PMBOK Guide)

The risk management strategies that participants reported are only partially in line with the systematic approaches recommended by ISO 31000:2018 and PMBOK Guide. ISO 31000:2018 focuses on an iterative process that is based on principles and includes communication and consultation, establishing the context, risk assessment (identification, analysis and risk evaluation), risk treatment, monitoring and review, and recording and reporting (International Organization for Standardization, 2018). Some of the participants' activities were informal and undocumented, such as field surveys to identify risk and expert judgment for analysis. Formal methods such as risk registers, structured workshops or systematic monitoring tools were virtually non-existent. Risk management was based on “meetings and discussions where risks were verbally prioritised” (P08), which was quite different from the structured and traceable processes required by the standard.

Likewise, the PMBOK Guide's seven risk management processes are seldom applied completely (Project Management Institute, 2017, 2021): Plan Risk Management,

Identify Risks, Perform Qualitative and Quantitative Risk Analysis, Plan and Implement Risk Responses, and Monitor Risks. Risk identification was quite experience-based and quantitative analysis was largely absent, because of data limitations and inadequate technical expertise. Qualitative risk matrices and expert judgment predominated, and were only superficially related to the qualitative analysis step of PMBOK. Vargas and Campos (2022) reported that both the ISO 31000 and PMBOK offer excellent guidance but sometimes their implementation in resource-poor settings is rather superficial. In road sector of Nepal, the disconnect with formal standards and on ground implementation is evident and this leads to reactive instead of proactive implementation of risk management.

5.1.2 Consistent with the Megaproject Paradox and Behavioural Explanations

The findings of the study are significant in that they reinforce Flyvbjerg's (2009) “megaproject paradox” that large infrastructure projects regularly suffer huge cost overruns and delays even though knowledge of project management has advanced. Risks identified (or not) during planning were always reported as significant issues for the implementation of the projects, for example geotechnical risks in the Daunne stretch of the Narayanghat-Butwal project, and also for the delay in land acquisition and unrealistic budgeting. This trend is similar to the optimism bias as mentioned by Lovallo and Kahneman (2003), which suggests that planners are systematically optimistic about benefits and underestimate costs and risks. Some of the participants explained how strategic misrepresentation (Lovallo et al., 2023) has occurred, whereby actors downplay the risks in order to get approval and funding, due to political pressure to get projects moving quickly.

Planning turned out to be the key lock-in for these risks, in line with Williams and Samset (2010). Insufficient geotechnical data and lack of stakeholder consultation had been resulted in the formation of path dependencies that were very difficult to rectify at a later stage. The evidence from Nepal, therefore, adds to Flyvbjerg's thesis, by illustrating how behavioural biases and institutional weaknesses combine in developing country settings to foster poor project outcomes.

5.1.3 Institutional and Governance Challenges in Developing Country Contexts

The interview data offer good evidence of how institutional and governance weaknesses affect effective risk management in developing countries. Lack of inter-agency coordination (10/12 participants) and overlapping responsibilities, bureaucratic delays, and political interference were all mentioned as significant obstacles. Such challenges are similar to the general literature on infrastructure in low and middle-income countries (LMICs) (Mazher et al., 2022; World Bank, 2019). Nepal's federal system of government has led to a decentralisation of power with the federal, provincial and local governments, making coordination even more challenging, especially in the areas of acquiring land, gaining environmental clearance and allocating resources.

Formal frameworks are also limited by lack of technical capacity and lack of data availability. Outdated surveys, a lack of historical data and lack of resources to conduct detailed geotechnical investigations were cited as issues. It is hard to break away from experience learning and reactive habits toward the systematic process using evidence that is recommended by ISO 31000 and PMBOK. Political and regulatory uncertainty is another challenge: The frequent changes of policy and the effects of local interference are a hindrance to continuity of planning. It is these contextual factors that can account for the limited institutionalisation of formal standards in everyday practice despite the fact that they are recognised.

5.1.4 Contribution to the Conceptual Framework

The results give strong empirical support and extension to the conceptual approach outlined in Chapter 2, which sees risk management practices as lying at the intersection between formal standards, institutional context and professional practice. The study clearly shows how formal frameworks (ISO 31000 and PMBOK) provide clear prescriptions, but the institutional context in Nepal, with its fragmentation of governance, limited resources, and political dynamics, plays a key role in how the frameworks are implemented. Pragmatic, experience-based approaches to professional practice, valuing instant, tangible risks over strategic, long-term risks, in turn, respond to these realities.

This dynamic interaction is the reason for the lack of progress between recommended processes and outcomes. The framework is brought to live by highlighting how individual expertise can be a strength (enabling rapid decision making in complex terrain) while also being a limitation (can result in lack of consistency and limited foresight). The study's practitioner-centred approach has the advantage of not staying in the realm of abstract ideals but rather exposes context-specific mechanisms that influence risk management in the road sector in Nepal. The lessons learned from these insights are relevant to other developing countries with similar institutional and topographic conditions.

To conclude, the comparative study validates that the current risk management process in Nepalese road projects are far from international standards and are largely dependent on behavioural biases and institutional weaknesses in the system. Such understanding can serve as a solid basis for practical recommendations in following sections.

5.2 Overview of Findings

A thematic analysis of semi-structured interviews with 12 professionals in federal, provincial, local government, consultancy, contractor, and academia shows a common trend in how strategic risk management is being practiced at the planning stage of road infrastructure projects in Nepal. Risk management is still largely informal, experiential and reactive and not systematic and proactive. These findings directly relate to the main research question and all three supporting questions, and, crucially, reveal the strengths of practitioners' expertise, as well as the wide gap between practitioners' current knowledge and best international practice (ISO 31000:2018 and PMBOK Guide).

Seven primary risk categories emerged in the interviews and were found to be highly interdependent: (1) geotechnical/topographical risk, (2) land acquisition/social risk, (3) budgetary/financial risk, (4) environmental/regulatory risk, (5) political/governance risk, (6) coordination/stakeholder risk, and (7) design/data/feasibility risk. The geotechnical and land acquisition risks were almost ubiquitous as per the difficult topography and socio-political conditions of Nepal. None of these risks are likely to happen in isolation – a lack of geotechnical information is likely to lead to delays in land acquisition, cost

overruns and coordination failures and are systemic issues that start in the planning phase but become apparent during construction.

Very few formal methods of risk identification, such as risk registers or structured workshops, were used; rather, the field surveys, feasibility studies/DPR preparation, stakeholder consultations, and expert judgment were widely used. The risk analysis and risk evaluation was largely qualitative and mainly relied on expert judgment and simple risk matrix, with few quantitative methods and formal frameworks used because of a lack of data and technical skills. Improvements were practical and mostly reactive, focussed on engineering solutions (e.g. slope protection and drainage), and with very little use of formal risk treatment plans, and stakeholder negotiations.

Governance and coordination were identified as key gaps, with participants often reporting on the lack of effective coordination, delays in the bureaucracy, political influence, and lack of inter-agency communication. The overall rating of the current practices was moderate for immediate, visible risks and weak for strategic, long-term risks. The need for institutionalisation of formal arrangements, improvement of data quality, better coordination and development of professional and technological capacity were strongly recommended.

Table 9. Summary of Key Themes from Interview Findings

Theme	Core Characteristics	Key Implication
Most Common Risks	Geotechnical, land acquisition, financial	Highly interdependent, planning-origin
Risk Identification Practices	Informal, field-based, expert-driven	Reactive, limited documentation
Risk Analysis & Evaluation	Qualitative dominance, expert judgment	Low use of formal/quantitative tools
Risk Mitigation Strategies	Engineering & stakeholder-focused	Mostly reactive, inconsistent implementation
Governance & Coordination Challenges	Fragmented institutions, political interference	Major barrier to effective RM
Overall Effectiveness	Moderately effective for immediate risks	Weak on strategic & long-term risks
Recommendations	Formal frameworks, data quality, coordination	Clear pathway for systemic improvement

The results provide a coherent picture which highlights that Nepalese road practitioners have a good knowledge of the practical aspects of the road and are also very flexible, but without the institutionalised process, the effect of risk management is limited. These patterns testify to the conceptual framework (Chapter 2) whereby formal standards are translated into informal experiences of work and shaped by the institutional context. The next section offers more in-depth interpretation of these practices.

5.3 Insight of Strategic Risk Management Practices in the Planning Phase of Road Infrastructure Projects in Nepal.

Through thematic analysis of the interviews with 12 experienced professionals, rich and contextual insights into the practical application of strategic risk management in the planning stage of road infrastructure projects in Nepal were gained. Risk management is not done systematically, proactively as promoted by international standards, but is still done on an informal, experience and reactive basis. This section translates the major findings into the conceptual framework and existing literature and draws conclusions regarding the strengths of current practices as well as some of the key weaknesses.

5.3.1 Most Common Planning Stage Risk and their Interrelationships

There were seven key risk categories, all of which were highly interdependent, were identified consistently: geotechnical/topographical, land acquisition/social, budgetary/financial, environmental/regulatory, political/governance, coordination/stakeholder, and design/data/feasibility risks. Geotechnical risk was virtually ubiquitous (12/12) and land acquisition risk (11/12) was reflective of the immense topography of Nepal and complex socio-political environment. These risks don't typically stand alone. The lack of good geotechnical data often leads to acquisition delays, and in turn higher costs and political involvement. Unrealistic estimates and inadequate grants are a central amplifier – budgetary risks. It proves the planning phase as a key risk source (Williams & Samset, 2010; Tserng et al., 2021) and directly contributes to Flyvbjerg's megaproject paradox that early cost and risk estimation underestimation results in ongoing cost overrun and delay (as happened in the Narayanghat-Butwal (Daunne) project).

5.3.2 Risk Identification Practices: Informal, Experience-Driven and Reactive

The identification of risks was informal and pragmatic in a large majority. The field surveys, reconnaissance visits, feasibility studies/DPR preparation, stakeholder consultations, review of past projects, and expert judgment were the primary ways participants engaged in the process. Formal means of communication like risk registers, checklists or specific workshops were almost non-existent. Although these approaches help the professionals to react promptly to visible site specific dangers, they are not well documented and comprehensive. Many risks only manifest themselves during the construction process and were not well identified earlier. This reactive pattern is consistent with what was described in Chapter 2, as the lack of data, limited coordination and lack of resources limit practitioners to relying on their own experience instead of the processes recommended by ISO 31000:2018 and PMBOK.

5.3.3 Risk Analysis and Evaluation Practices: Qualitative Dominance of Formal Tools

Risk analysis was largely qualitative and expert judgment and simple risk matrices (low/medium/high) were employed by all participants. One participant each reported quantitative techniques, and formal frameworks (ISO 31000 or PMBOK). Safety was always considered first, second were the time and cost impacts. Although this can allow quick judgment to be made in a complex and information-poor environment, this results in a subjective judgment, lack of uniformity and lack of traceability. Expert judgement is heavily relied upon, which helps to overcome the weaknesses of institutions, but is not conducive to organisational learning and repeatability. These results support the existing evidence on the need to change this situation of unbalanced qualitative–quantitative analysis, which contrasts with international views that emphasize this balance (Vargas & Campos, 2022; Mazher et al., 2022).

5.3.4 Strategies for Mitigating Risk: Mostly Reactive but Practical

Mitigation measures were realistic and based on a series of engineering solutions (slope protection, drainage and retaining walls) along with stakeholder engagement. These, however, were found to be mainly reactive and late. Formal risk treatment plans were virtually unknown. The participants gave examples that were very illustrative of the

rework, cost overruns, and safety concerns that were the result of inadequate early mitigation efforts, for example, not recognizing landslide prone areas or not taking action on erosion control in a timely fashion. This ‘reactive’ pattern further sustains the concept of how the institutional context influences formal standards' translation into practice, which ranges from ad hoc to strategic responses.

5.3.5 Risk management, Governance and Coordination Issues

The governance and inter-agency coordination was the most widespread underlying challenge. The distribution of responsibilities between different levels of government (federal, provincial and local) and the bureaucratic delays, information silos, and political interference all have a significant impact on effective risk management. These issues can be interpreted as implementation crises and risks identified. The results align well with literature on the infrastructure of developing countries (World Bank, 2019; Mazher et al., 2022), which finds that formal standards are built on competent and coordinated institutions which are not always found in the federal system of Nepal.

5.3.6 Overall Performance of Risk Management Practices in place

Current practices were perceived as being moderately effective for immediate and visible risk (especially safety) and weak for strategic and long-term risk by participants. It works very well in pragmatic and experience-based responses, but lacks foresight and is inconsistent and does not generate institutional learning. This moderate effectiveness is due to the complex relationship between formal standards, institutional weaknesses and professional practice which is at the heart of the study's conceptual framework. Although practitioners show great flexibility in the difficult context of Nepal, the system of not having systematic processes extends the delays and cost overruns.

Finally, there are signs of professional ingenuity working in the face of extreme institutional limitations in the field of strategic road planning risk management in Nepal. The findings not only support the conceptual approach but also highlight the need for institutional reform that is sensitive to the context at hand, and that can help to overcome the disconnect between international practice and reality in the ground.

5.4 Strategies for Improving Strategic Risk Management Practices in Road Infrastructure Projects in Nepal.

The interpretation of the results of the previous section shows the gap between the formal ideals of international risk management standards and the informal and reactive nature of Nepal's road infrastructure planning phase. Existing approaches show a high level of professional creativity and pragmatic adjustment to the extreme terrain, scarcity of resources and multi-level governance issues, but lack consistent, proactive and strategically strong results. This section puts these insights into actionable strategies for enhancement. Based on the participants' suggestions in Chapter 4.7, the comparison analysis with ISO 31000:2018 and the PMBOK Guide, and the conceptual framework in Chapter 2, four strategies are suggested, which are interconnected. The recommendations are intended to be contextually implementable in the context of Nepal's federal system, and to tackle the underlying drivers of optimism bias, strategic misrepresentation and institutional weaknesses that are mentioned in the literature.

5.4.1 Formal Risk Management Frameworks to be institutionalized

The most basic and essential of the strategies is the institutionalization of formal risk management frameworks in a systematic manner across the Department of Roads and related agencies. The need to break free from the ad hoc and experience-based approaches was reiterated by the participants. *"Formal risk registers, risk workshops with all stakeholders in structured format and training to ISO 31000 or PMI concepts",* as P08 said, are essential. In a similar fashion, P09 suggested *"embedding risk management in the initial planning phases and harmonization of international standards such as ISO 31000."* P01 explicitly called for the *"Adopt systematic risk management frameworks"* and *"Introduce risk registers in all projects."* This is directly related to the principles and process of Risk Management as described in ISO 31000:2018 which encourages the incorporation of Risk Management into the decision-making process of an organisation instead of as a standalone process. The seven risk management processes outlined in the PMBOK Guide could be used as a practical guideline and could be customized through pilot projects in the high-risk sections like Daunne or Karnali.

Mandatory risk registers in all Detailed Project Reports (DPR) would help develop an audit trail, increase traceability and decrease the current verbal prioritisation, which results in inconsistent risk evaluation. This institutionalisation would also help to overcome optimism bias, by necessitating the documentation of assumptions and contingencies in feasibility studies. In order to ensure feasibility, the Department of Roads could start with some specific capacity building programmes for the Project Implementation Units and then expand the framework to provincial and local levels. This would help to close the divide between the formal requirements of the standards and the practice of risk management as identified in the conceptual framework; and would enable risk management to become an organisational competency rather than an individual responsibility.

5.4.2 Enhancing Data Quality and Feasibility Processes

The second key measure is to improve the quality and thoroughness of data collection and feasibility studies, as these were seen as a common challenge in the process of identification and analysis. Inadequate geotechnical information, lack of historic data and superficial environmental assessment were often highlighted as key causes of issues downstream including delays in land acquisition, cost overruns, and landslides. *"The planning must be rigorous, multi sectoral, must be based on facts and data."* said P02. This was followed up by P01's call for *"Improve data collection and feasibility studies."* The study suggests that, to overcome this, it is necessary to include the use of advanced technology tools like Geographic Information Systems (GIS), drone based topographic surveys and multi-hazard risk mapping in the DPR preparation process. These tools would help to identify geotechnical and environmental risks more accurately at an early stage of the planning process, directly addressing the reactive nature of current practice, described in Chapter 4.2. In addition, a national risk database for roads, centralised and based on lessons learnt from the previous projects and using real time climatic and seismic data, would help in minimizing the reliance on the individual experts' judgment. This would fit with the literature that has focused on the planning phase as the most important risk source and would enhance the institutional context part of the conceptual framework. The possibility of piloting a project could be started with donor-

supported projects (World Bank and Asian Development Bank projects already in place), and the results incorporated into the Department of Roads Norms. The result should be more realistic cost estimates and schedules, reducing the optimism bias and strategic misrepresentation patterns in the Narayanghat-Butwal case.

5.4.3 Improve governance and inter-agency coordination

The third pillar is about improving governance and inter-agency coordination systems, something that was always identified by the participants as one of the largest impediments to effective risk management. The current situation of having responsibilities spread out between federal, provincial and local governments, with information silos and political interference, is an impediment to timely risk mitigation. P01 included the following elements: *"Strengthen inter-agency coordination"* and *"Ensure early land acquisition and stakeholder engagement.*" P05 and P08 emphasized the need for a clearer definition of roles and less bureaucracy. It is recommended to set up formal inter-agency risk coordination committees at national and provincial levels with well defined terms of reference, which include the requirement for inter-agency risk workshops in the feasibility phase. There should be binding guidelines for the land acquisition and environmental clearance processes in order to make early and structured stakeholders' engagement, especially of local communities, ward offices and affected landowners, institutionalised. These measures would help to put into practice the communication and consultation principles of ISO 31000:2018 and would help to overcome the multi-agency coordination failures as highlighted in Chapter 2.3. It was proposed to help mitigate the potential for political influence to reduce the independence of the technical review panels and to make them part of the approval process for major projects, so that political pressures on planning decisions are mitigated. This would increase the accountability, better flow of historical data between agencies and provide for the stable institutional environment that would allow professional practice to thrive. Support for implementation could be done by means of policy guidance from the Ministry of Physical Infrastructure and Transport and monitoring could be linked to the release of funding for projects.

5.4.4 Building Professional Capacity and Technology Integration

Last, but not least, professional capacity and technology integration is a cross-cutting strategy that is a prerequisite for the success of the three above mentioned strategies. Some of the suggestions were for a focus on training specifically on ISO 31000 and PMBOK principles, as well as the use of Building Information Modelling (BIM) to visualise risks in the design stage. P01 specifically recommended the following actions: *"Increase use of technology (GIS)"* and Training of engineers and planners. P08 *"the incorporation of BIM for risk visualisation, and the provision of dedicated contingency budget for geotechnical risks."* The lack of technical capacity and data was mentioned throughout the interviews and could be improved by regular workshops, certification schemes and knowledge sharing platforms, turning individual capacity into collective organisational capacity. Incorporation of digital technologies like real-time risk dashboards and mobile applications for field data collection would further help to minimise reliance on informal approaches and enhance monitoring and review practices. This capacity building would also help to create a culture of proactive as opposed to reactive risk management, which is in line with the continuous improvement principle of ISO 31000:2018. To ensure sustainability, the recommendations are to engage academic institutions like IOE Pulchowk Campus in curriculum development and study on Nepal specific risk model. The conceptual framework posits that building up professional practice in this way would produce positive feedback loops, which would lead to a decrease in the disconnect between the formal and the enacted standards over time.

These four strategies represent a coherent, phased roadmap for the changes in strategic risk management in the road infrastructure sector in Nepal. From pilot projects in priority corridors to scaling up via policy and training, and then institutionalising via new norms and technology platforms, would result in measurable changes in the predictability of projects, cost control, and satisfaction of stakeholders. The findings of this study, identifying gaps in the literature relating to informality, reactivity and institutional fragmentation, have been addressed by the recommendations, which not only respond to the voices of the participants but also make a contribution to the literature on risk management in the context of developing countries. If successful, the

adoption would shift Nepal's road sector from a moderately effective, experience-based approach to a more structured, proactive and resilient road sector to provide infrastructure that is responsive to national development objectives.

5.5 Limitations and Future Research

Despite the fact that this study has yielded valuable insights into the practices of strategic risk management in the planning stage of road infrastructure projects in Nepal, it has several limitations. A purposive sampling of 12 professionals from federal, provincial and local government, consultancy and contractor organisations was used. Although the sample was rich in themes and varied in terms of experience and project contexts (Terai plains and hilly regions), it was small and therefore not statistically generalizable. Despite taking measures to achieve reflexivity and member checking, the results are based on the participants' and the researcher's personal experiences and background as an engineer. In addition, the study was designed to focus on the planning stage and on road projects in the public sector and does not reflect risk management in construction, implementation or in the private sector. The data was gathered from February to April 2026, and changes of policies or recent institutional developments in Nepal's federal system may not be captured. Lastly, the qualitative design, which was suitable for lived practices, failed to measure the identified risks or the effectiveness of the identified mitigation, using quantitative methods.

Despite the limitations, the study makes an important contribution in the sense that the conceptual framework is based on actual practitioner voices and the lack of congruence between international standards and local practice is evident. These limitations should be addressed in future research in a number of ways. Implementation of the recommended risk registers, GIS integration and inter-agency coordination mechanisms could be followed over full project life cycles in longitudinal studies to determine the actual impact on cost and schedule performance. Larger-scale surveys and in-depth case studies would be well suited to a mixed-methods design that would enable statistical testing of the conceptual framework and generalisation to the various provinces of Nepal. Comparative studies of similar road projects in other developing countries (e.g., Bhutan, Bangladesh or sub-Saharan Africa) would shed light on context-specific and

universal factors in risk management. Also, experimental or action-research projects testing the new capacity building and technology integration approaches might provide real-world data for policy makers. These extensions would further increase the literature on how to manage infrastructure risks in resource limited environments.

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Appendix 1. Participants

Participant ID	Organization / Affiliation	Position / Role	Years of Experience	Primary Involvement Areas
P01	Rural Municipality (Achham)	Civil Engineer	2	Planning & Construction
P02	IOE, Pulchowk Campus, Tribhuvan University	Assistant Professor	4	Academic / Research
P03	Road Division, Dang	Engineer	11	Construction / Supervision
P04	Department of Roads (DoR)	Engineer	3	Construction / Supervision
P05	Department of Roads (DoR)	Highway Engineer	10	Construction / Supervision
P06	National Novel Engineering Consultancy / DUDBC	Engineer	5	Construction / Supervision
P07	Madhuwan Municipality, Bardiya	Head of Infrastructure Development Section	8	Planning, Design, Construction & Governance
P08	Religare Construction Pvt. Ltd	Site Engineer	3	Construction / Supervision
P09	K.A.P Construction Pvt. Ltd.	Engineer & Owner	5	Construction / Supervision
P10	National Engineering Consultancy	Site Engineer	4	Planning / Feasibility + Supervision
P11	Extra Tech International	Site Engineer	3	Construction / Supervision
P12	Mangalsen Municipality, Achham	Engineer (Head of Infrastructure Branch)	6	Planning, Design, Supervision & Governance