RESEARCH ARTICLE

Integrating the Risk Management Process into the Landscape Project Lifecycle Through an Iterative Multi-Pass Looping Approach

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Abstract

Effective integration of the Risk Management Process (RMP) within the landscape project lifecycle is essential for enhancing project outcomes and reducing vulnerabilities. Conventional single-pass approaches are often inadequate, resulting in inefficiencies and suboptimal risk mitigation. This study introduces a conceptual framework for embedding an iterative multi-pass RMP (recommended for two to three cycles) within the landscape project lifecycle. Derived from a systematic review of current practices, the framework is built upon three core constructs: (1) execution of all six RMP steps across two to three iterative cycles, (2) initiation of risk activities from the earliest project stages, and (3) continuous and concurrent application of RMP throughout each project phase. To validate the framework, a focus group discussion involving six stakeholders from the construction industry was conducted. The findings confirm the model's practical relevance and potential to improve risk identification, analysis, and response through enhanced timing and consistency. This research contributes to landscape project management by offering a structured, dynamic approach to risk integration that aligns with sustainable development goals and improves decision-making across the project lifecycle.

Keywords: *Iterative Multiple-Pass Looping, Landscape Project, Project Lifecycle, Risk Management Process*

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Introduction

Landscape projects face unique challenges, including site-specific environmental concerns, changing client requirements, high levels of stakeholder diversity, and less predictable funding or regulatory cycles. These complexities justify the need for a dynamic, integrated risk management framework tailored to this context. Landscape projects are inherently dynamic, complex, and high-risk, falling within the broader construction sector. Sankar and Shashikanth (2022) note that both predictable and unforeseen risks can significantly impact construction operations, processes, environments, and organisations. The application of risk management in landscape projects differs markedly from other industries, such as engineering, where actuarial methods are commonly employed (Bahamid et al., 2022; Meijering

et al., 2015). Given the numerous ambiguities and uncertainties related to ecological, environmental, cultural, and social factors, effective risk management in landscape projects demands a substantial degree of professional intuition. Moreover, the diverse values, needs, assumptions, concepts, and concerns of stakeholders shape the perception and management of risk within these projects (Arashpour et al., 2016; Capouya et al., 2012; S.Muthuveeran et al., 2024). Due to the dynamic, complex, and time-sensitive nature of landscape projects, risk management must be embedded as a unified and continuous process within landscape project management. The COVID-19 pandemic and subsequent Movement Control Order (MCO) in Malaysia highlighted the need for adaptive and iterative risk management approaches to ensure project resilience amid disruptions to operations, supply chains, and finances to landscape projects (Sapian et al., 2022).

Despite the critical importance of integrating the risk management process (RMP) into the project lifecycle, most prevailing risk management standards and guidelines provide limited detail on this integration (Bąk & Jedynak, 2024; S.Muthuveeran, Tahir, et al., 2022). Nonetheless, these documents articulate effective risk management practices that emphasise the need to understand the nature and scope of decision-making in project management. The project lifecycle serves as a fundamental framework for examining these decisions and the associated risks. To effectively identify risk sources and devise appropriate mitigation strategies, a structured approach to integrating the RMP within the project lifecycle framework is imperative. While evaluations often focus on risks related to the project's physical attributes, the project management process encompasses a broader range of significant risks. Hammad and Inayat (2018) argue for the unification of the overall project and the RMP to streamline project management. This integration facilitates management efficiency for landscape architects and allows project organisations to avoid the complexities of managing two separate processes. Comprehensive standards such as those developed by the Association for Project Management APM (2010) and Ward et al. (2003) offer robust frameworks for embedding RMP within the project lifecycle; however, these frameworks require updating to align with contemporary project lifecycle demands.

Traditionally, the RMP is executed in a single linear pass, often with only one complete cycle. Cevikbas, Okudan, and Işık (2024) critique this approach as inefficient and ineffective, as it can lead to wasted time by focusing on trivial risks and neglecting the need to revisit risk assessments. Similarly, APM (2010) highlights that the linear single-pass approach limits the availability of sufficient information for comprehensive risk profiling, due to suboptimal time allocation. Although the RMP is typically portrayed as a sequential process, its practical application is iterative. Consequently, an iterative multiple-pass looping approach is advocated over the traditional linear single-pass method to enhance the effectiveness of risk management (APM, 2010; Chapman & Ward, 2003; Jayasudha & Vidivelli, 2016).

To address these gaps, this study poses two critical research questions: (1) how can the RMP be effectively integrated into the project lifecycle, and (2) how can this integration be operationalised through an iterative multiple-pass looping approach to improve risk management effectiveness in landscape projects? Accordingly, this research aims to conceptualise the integration of the RMP into the project lifecycle via an iterative multiple-pass looping framework tailored for landscape project organisations.

Iterative Multiple-Pass Looping RMP Practice

The RMP is iterative, although ISO 31000:2018 (2018) classified it as sequential. An iterative multiple-pass looping RMP is recommended instead of a linear one (APM, 2010; C. Chapman & Ward, 2003; S.Muthuveeran, Mohd Tahir, et al., 2022). Figure 1 shows three complete RMP cycles. Iterating back to prior phases

develops, refines, or reconsiders analysis. BS 6079-1:2010 (2010) and PMI (2021) describe this iterative movement as a project lifecycle flow that is generally iterative or overlapping. BS IEC 62198:2001 (2001) recommends managing risks at each project phase iteratively.

The RMP serves not only to identify overarching risk concerns but also to scrutinise specific risks and their potential manifestations. According to APM (2010), the initial iteration of the RMP should adopt a strategic focus aimed at pinpointing areas that require more detailed analysis. This strategic phase is best undertaken before project definition, where critical decisions are made. Subsequently, the frequency and timing of further iterations are determined by project requirements and are typically scheduled at key milestones or regular intervals throughout the project lifecycle. Conducting three iterative cycles is generally appropriate, contingent on project complexity and demands. The subsequent tactical iterations address the remaining stages of the project lifecycle, facilitating ongoing risk management and adjustment.

Given the dynamic and complex nature of risks inherent in landscape projects, the iterative application of the risk management process (RMP) is strongly recommended. ISO 31000:2018 (2018) emphasises that hazards may evolve or cease to exist as an organisation's internal and external contexts shift. Consistent with this, APM (2010) highlights the continuous nature of the RMP, asserting that project teams must engage with risk management daily to anticipate, detect, acknowledge, and respond promptly to emerging changes and events. This necessitates an iterative approach that maintains up-to-date assessments of project risk exposure and adapts risk responses accordingly. Further reinforcing this view, BS 6079-3:2000 (2000) and ISO 31000:2018 (2018) underscore the iterative character of the RMP, which enhances decision-making processes, informs project strategy, and supports the achievement of project objectives.

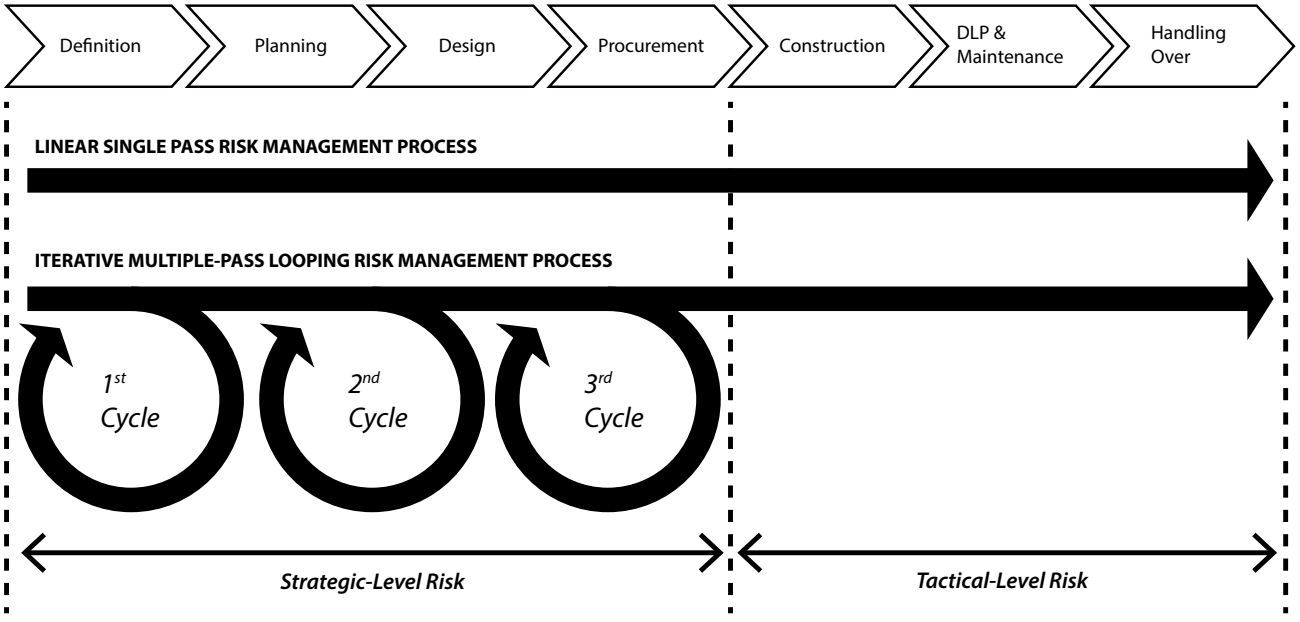

Figure 1: Linear Single Pass vs. Iterative Multiple-Pass Looping RMP

(Source: Adapted from APM (2010), BS 6079-1:2010 (2010), BS IEC 62198:2001 (2001), Chapman and Ward (2003), ISO 31000:2018 (2018), PMI (2021)

Concept for Integrating the RMP into the Project Lifecycle Through an Iterative Multiple-Pass Looping Approach

Risk assessment typically centres on the specific risks associated with a project. However, the broader project management process itself introduces numerous significant risks. Hammad and Inayat (2018) argue that integrating the project management process with the risk management process (RMP) simplifies overall project governance. Linking these processes provides clear guidance for practitioners in managing project risk and offers organisational benefits by eliminating the need to monitor two separate workflows. In comparison, disciplines such as urban planning and civil engineering often utilise integrated risk frameworks that are embedded within spatial or systemic infrastructure models. These cross-disciplinary practices offer valuable insights into structured integration that could be adapted for landscape contexts.

This study further observes that while most risk management standards and guidelines articulate effective risk management practices, they often lack detailed guidance on how to integrate the RMP within the project lifecycle. A thorough understanding of decision-making processes in construction management is crucial for recognising the full potential of risk management in project contexts. The project lifecycle provides a suitable framework to analyse these decisions and their associated risks (Chapman, 2012; S.Muthuveeran et al., 2024; J. Ward, 2013). Accordingly, a systematic approach to integrating the RMP within the project lifecycle framework is essential to identify sources of risk and develop effective adoption strategies (BS 6079-1:2010, 2010). The development of such a framework is imperative to enable landscape project practitioners to apply risk management effectively throughout the project lifecycle.

Figure 2 presents a comparative analysis of risk integration frameworks employed within the project lifecycle. The review underscores the importance of initiating the risk context during the early project definition phase. Following the completion of project planning, the risk assessment and treatment processes begin, incorporating risk identification, analysis, and evaluation. Chapman and Ward (2003) and APM (2010) recommend executing these processes through two to three iterative loop cycles to enhance effectiveness. Importantly, risk treatment measures should be implemented early in the design phase. Risk monitoring, control, and communication are continuous activities maintained throughout the entire project lifecycle. This study adopts the iterative looping cycles and underlying principles advocated by Chapman and Ward (2003) and APM (2010), emphasising the early initiation of risk management practices within the project lifecycle.

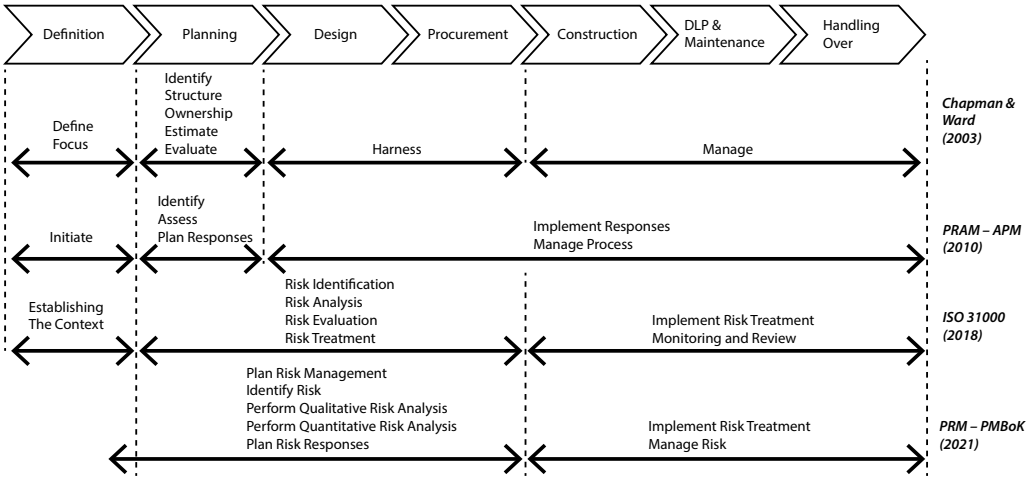

Figure 2: Risk Management Process Integration into the Project Lifecycle

The concept for an effective RMP integration into the project lifecycle should fulfil three aspects: process steps' completeness, process activity planning, and process activity flow illustrated in Figure 3. First, the RMP should complete all six steps, followed sequentially and computed in two to three iterative cycles. Second, the RMP activities are planned and initiated at the earliest phase of the project lifecycle. Finally, to ensure its success, the RMP activities should flow concurrently within the project phase and continuously throughout the project lifecycle.

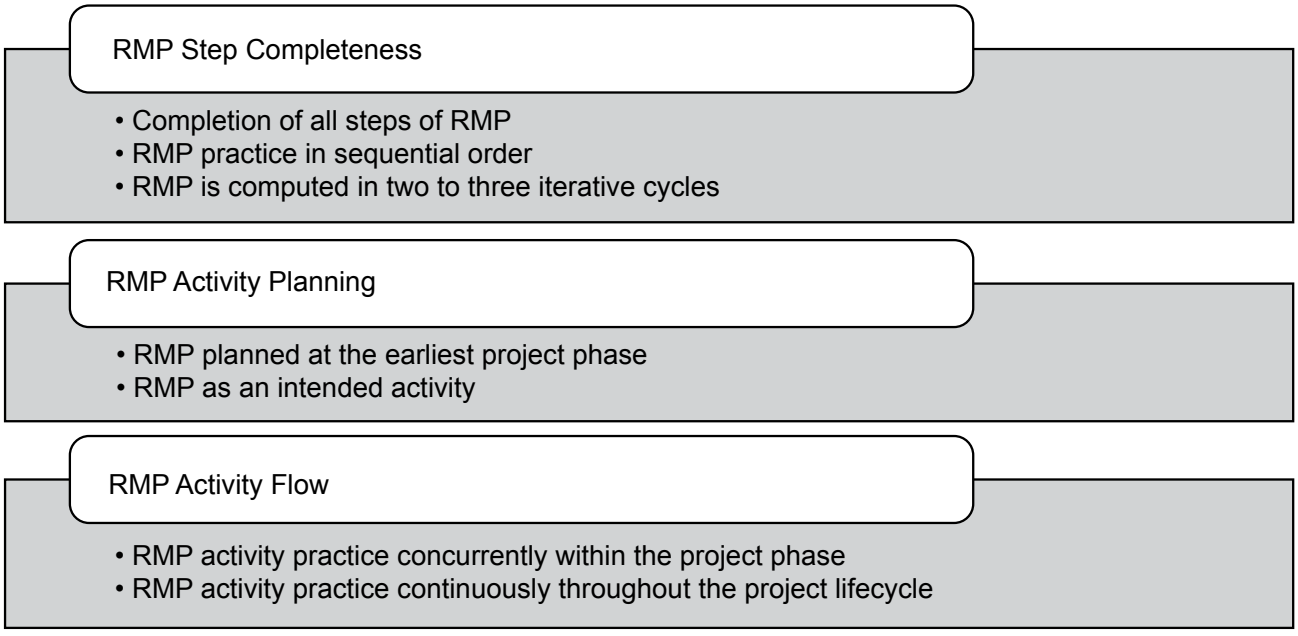

Figure 3: A Concept Integrating the RMP into the Project Lifecycle Through an Iterative Multiple-Pass Looping Approach

Methodology

The validation of the conceptual framework was conducted through a focus group discussion (FGD) involving six stakeholders from the construction project sector. The FGD aimed to validate the integration of three key components of the risk management process (RMP): process step completeness, process activity planning, and process activity flow, within the project lifecycle via an iterative multiple-pass looping approach. For confidentiality and ease of reference, each participant was assigned an alphanumeric code. Participant backgrounds are detailed in Table 1. The validation process commenced with a presentation of the conceptual framework, including an explanation and justification of its applicability within the landscape project context. Participants were invited to critically discuss each construct and component of the framework. Subsequently, each participant articulated their agreement or disagreement regarding the inclusion of specific elements within the concept, providing justifications for their positions. This was followed by a facilitated group discussion to elicit diverse perspectives and insights on the framework. The session concluded with the consolidation of overall consensus among participants, which was reconfirmed to formally close the discussion and affirm the framework's validity.

Six participants were selected using purposive sampling to represent diverse professional backgrounds within the construction industry, ensuring a range of perspectives relevant to risk management in landscape projects. The FGD responses were thematically analysed using manual coding to identify consensus points across core framework constructs. Informed consent was obtained from all FGD participants, and the study protocol was reviewed to ensure compliance with ethical consideration standards.

Table 1: FGD Participants Information

Participants	Industry	Scope	Current Position	Education Background	Years of Experience
F01	Construction	Architecture	Project Director	BA. Business Study	38
F02	Construction	Civil Construction	Director	BA. Technology Management / MA. Safety Environment	27
F03	Construction	Quantity Surveying	Partner (QS)	BA. Quantity Surveying	21
F04	Construction	Interior Design	Director	Dip. Interior Design	39
F05	Construction	Urban Planning	Senior Executive, Strategic Planning and Business Development	BA. Town and Regional Planning / MA. Construction Business	12
F06	Construction	Landscape Architecture	Landscape Architect / Director	BA. Landscape Architecture	31

Findings

RMP Step Completeness

As part of the RMP step completion validation, participants engaged in a focused discussion on the integration of the RMP within the project lifecycle, summarised in Table 2. The consensus highlighted that the framework must encompass all components required for successful RMP integration, ensuring that the six process steps are completed sequentially and iterated through two to three cycles. Given that landscape architecture practice predominantly emphasises the planning phase, participants recommended incorporating iterative sub-phases within this stage and explicitly defining them in the framework. Consequently, two to three iterative cycles are primarily conducted during the planning phase, rather than later stages of the project lifecycle, to better align with professional practice and project demand.

Table 2: RMP Step Completeness

Validation	Selected FGD Responses	Consensus
Completion of all steps of the RMP	*"…establish risk context step done at earlier and once…but to revisit timely" (F05)* *"identify risk important…but to treat is most crucial, implement the treatment action is mandatory" (F01)*	Appropriate to be included in the framework.
RMP practice in sequential order	*"support…no shortcut or jump queue in practice. Should be done immediately" (F03)* *"…risk process to be in sequence, follow the suggested step…" (F06)*	Appropriate to be included in the framework.
RMP is computed in two to three iterative cycles	*"suggest to put this iterative cycle to specific sub-phase of the project lifecycle" (F04)* *"Each preceding cycle info or action planned taken to be included in next cycle" (F04)* *"...I believe this move will advocate any miss or emerging risk to be taken care of" (F01)* *"first cycle to start at earliest project lifecycle..." (F05)*	Appropriate to be included in the framework. Suggest including an iterative cycle in the sub-phase and indicate in the framework.

RMP Activity Planning

Participants elaborated on the integration of the risk management process (RMP) into the project lifecycle as a critical aspect of RMP activity planning. The discussion outcomes and consensus are summarised in Table 3. The findings indicate unanimous agreement that all components supporting the early planning and deliberate initiation of RMP activities within the project lifecycle are essential and appropriately incorporated into the conceptual framework.

Table 3: RMP Activity Planning

Validation	Selected FGD Responses	Consensus
RMP planned at the earliest project phase	*"risk is highest and unknown during early project undertaking…we still unclear with client scope, budget and expectation" (F04)* *"Agreed on risk to be studied as early as possible… manage risk later in construction is too late" (F03)* *"Adding to F03, some safety issue happens in construction, but it happens due to no proper planning, which project fail to manage earlier…due to construction culture I guess" (F01)* *"All professional and project manager to sit together and discuss risk at earliest project initiation…some professional come in late in project…" (F04)*	Appropriate to be included in the framework.
RMP as an intended activity	*"…should not be ad-hoc or when there is a problem or concern…most time when there are major issues than only all react" (F04)* *" Agreed with F04, risk should be handled intentionally…rather as ad-hoc manner" (F06)*	Appropriate to be included in the framework.

RMP Activity Flow

Participants discussed the integration of the risk management process (RMP) into the project lifecycle, specifically in terms of RMP activity flow. The outcomes of this discussion and the resulting consensus are presented in Table 4. The findings confirmed that all components supporting the concurrent execution of RMP activities within each project phase, as well as their continuation throughout the entire project lifecycle, are essential and appropriately incorporated into the conceptual framework.

Table 4: RMP Activity Flow

Validation	Selected FGD Responses	Consensus
RMP activity practice concurrently within the project phase	*"Each project activity happens within sub-phase of project lifecycle…risk to manage there and then rather push to another phase" (F01)* *"…risk process follow the project process...happen immediately, no delay" (F06)*	Appropriate to be included in the framework.
RMP activity practice continuously throughout the project lifecycle	*"…continuum from first step of RMP…to avoid miss out information" (F04)* *"Most risk management practice happened at earliest project…not carry out to next phase…this I believe not effective" (F01)*	Appropriate to be included in the framework.

Discussion

The conceptual framework was developed and subsequently presented during a focus group discussion (FGD) with construction project stakeholders to validate its three core components: RMP step completeness, RMP activity planning, and RMP activity flow. The industry participants demonstrated a clear understanding of the framework and acknowledged its practical applicability. The FGD yielded positive feedback, with stakeholders expressing willingness to adopt the framework alongside recommendations for refinement and suggestions for its implementation. A hypothetical conceptual framework, synthesised from the literature review and FGD insights, was formulated to ensure practical relevance tailored to the landscape project context and industry needs, as illustrated in Figure 4.

However, existing models often assume a universal project structure, which may not reflect the fragmented and fluid nature of landscape project delivery. The current framework addresses this gap, though future work should assess its applicability in different project environments. The proposed framework integrates risk management into the project lifecycle through an iterative, multiple-pass looping approach. It enables projects to execute the risk management process within a formalised structure, following a timely sequence that completes each risk cycle within every phase of the project lifecycle. The iterative nature begins at project inception and continuously utilises the most current project information. This framework is sensitive to the cultural characteristics of the industry and the inherent complexity of landscape projects. It is designed to evaluate organisational

and project-level risk management maturity, address the complexity of risk processes, determine the optimal timing to initiate risk activities within the project lifecycle, and facilitate seamless interaction with existing project operations.

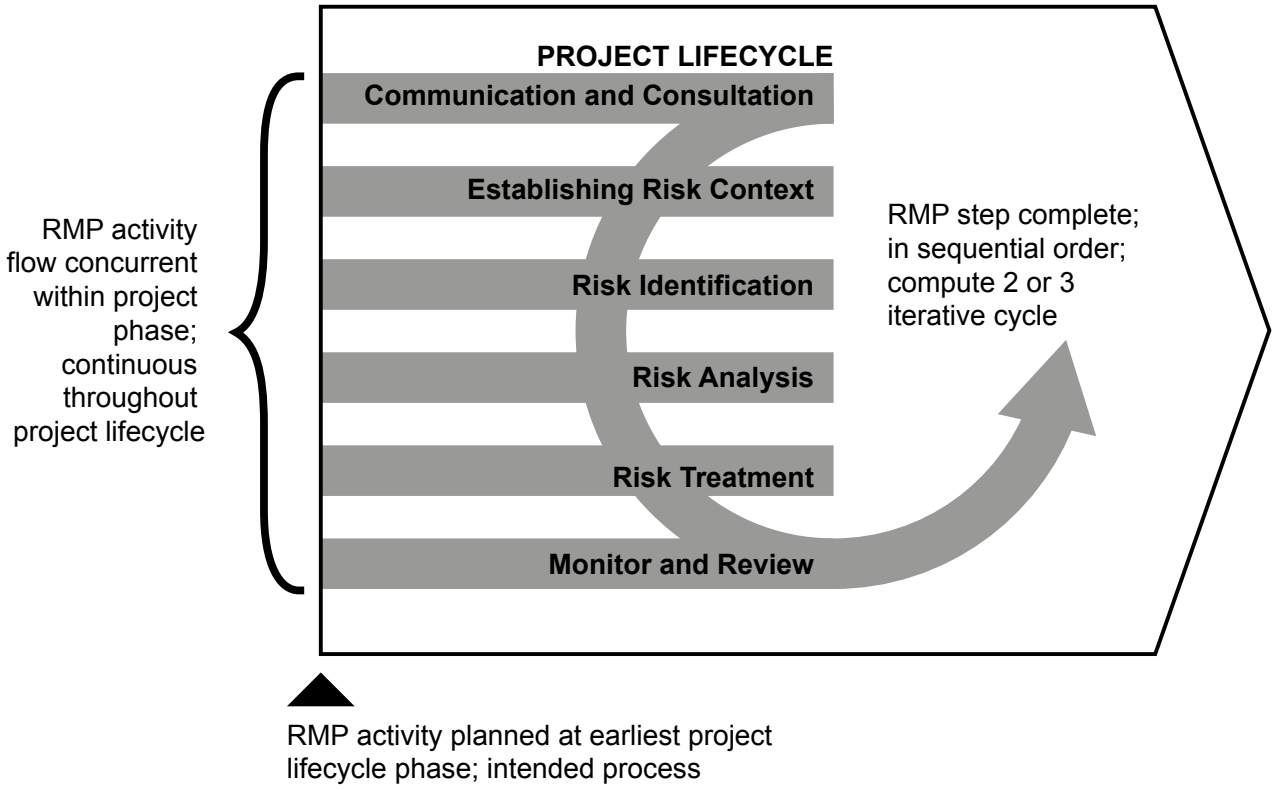

Figure 4: A Conceptual Framework Approach

Given the fast-tracked and dynamic nature of landscape projects, maintaining a separate, isolated risk process is both time-consuming and impractical. The framework advocates for proactive risk management, supported by committed leadership and exemplified by active engagement. By fostering a risk-aware culture, the continuous implementation of this strategy enhances organisational learning and risk management practices over time.

The framework advances risk management by enabling better control of complex project challenges and streamlining risk management procedures. It promotes a paradigm shift in project management from reactive, issue-driven approaches to proactive, practice-oriented methodologies—characterised by structural integration, systematic management, timely execution, and conscious planning. For practitioners managing fast-paced landscape projects, this integrated framework obviates the need to treat project management and risk management as distinct processes (S.Muthuveeran et al., 2023). To eliminate redundancy, it advocates for the simultaneous integration of risk management activities throughout the project lifecycle (PMI, 2021).

Conclusion

There remains a lack of clear guidance on how risk management should be systematically integrated within the landscape project lifecycle. This study addresses this gap through the development of a conceptual framework specifically designed to integrate the risk management process (RMP) into the landscape project lifecycle. The framework is tailored to align with the unique scope and

characteristics of landscape projects and is substantiated by validation from industry practitioners, emphasising the critical importance of practical applicability.

The proposed framework offers a hypothetical yet strategic approach to risk management tailored for landscape projects. It enhances the understanding and application of risk management, thereby enabling project managers to anticipate and address project challenges more effectively. By facilitating early identification of potential difficulties, the framework empowers project teams to proactively mitigate risks. Moreover, it is well-suited to contemporary iterative or hybrid project management lifecycles, fostering improved risk reduction, efficiency management, and dynamic problem-solving.

The conceptual framework was developed through a synthesis of established project risk management methodologies and insights obtained from interviews with landscape practitioners. However, it has yet to undergo external validation through industrial adoption. Future application and testing of this framework in practice would be valuable to further refine its effectiveness and confirm its utility within the landscape project management domain.

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