

**ENGAGEMENT IN RISK MANAGEMENT PRACTICES IN SOFTWARE  
DEVELOPMENT PROJECTS: FRAMING EFFECTS**

by

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## **Abstract**

Many software projects fail: they take more time than they were intended to, go over their budgets, and do not achieve the intended functionalities. Software project failures are caused in part by information systems (IS) project managers who fail to adequately identify, evaluate, and monitor risks that can and frequently do materialise. Much of the prior research on IS project risk management has focused on developing normative prescriptions, including risk checklists, risk frameworks, process models, and risk response strategies. However, it has been frequently noted that IS project managers sometimes do not follow these normative prescriptions or find them difficult to implement in practise. While there is a large body of literature describing what IS project managers should do, little is known about what they actually do. The purpose of this study is to advance experiential knowledge of IS project risk management; the aim is to understand how IS project managers engage in risk management and why they sometimes deviate from normative prescriptions.

To achieve this purpose, prospect theory is used as the main theoretical framework that guides this study. By drawing on prospect theory, this study focuses on how IS project managers interpret project-related information (i.e., project framing) and how this influences their engagement in risk management. Therefore, this study aims to address the following main research question: How does project managers' project framing influence their engagement in risk management?

This study used a qualitative approach to answer this research question because it aimed to investigate how project framing influences risk management engagement from the perspective of IS project managers. Consequently, multiple case studies were conducted on IS project managers' approaches and experiences regarding how project framing develops and impacts risk management engagement. Semi-structured interviews were the primary method used for collecting the data. A total of 26 interviews were conducted with project managers in various IT/IS companies in New Zealand. The interview data was analysed using the template analysis style of thematic analysis. Additionally, the MAXQDA qualitative analysis software was used to facilitate the analysis process.

Five major findings emerged from this study. First, IS project managers form a perception of a project based on objective attributes (e.g., project budget and time) and subjective attributes (e.g., project complexity and criticality). Second, to evaluate these attributes, IS project managers use different reference points obtained from past experience of managing similar projects or the information acquired during the evaluation process. Third, the evaluated attributes form the project framing, which IS project managers express by describing the attributes in positive or negative terms (i.e., attribute framing). Fourth, engagement in risk management is influenced by the compound evaluation of attributes (i.e., the project frame), a single attribute, or a group of

attributes. Fifth, the evaluation of attributes could change over the project lifecycle and influence engagement in risk management.

This study makes several theoretical contributions. First, for behavioural IS project risk management research, it explains how project managers' framing of IS projects influences their engagement in risk management and provides a broader definition of risk management engagement than that used in this literature. Second, it informs research on framing in IS project management by demonstrating how decision-makers, in real-life situations, subjectively frame decision-making information. Third, it contributes to prospect theory by denying the unidimensionality of problem framing, accounting for hybrid framing, and viewing framing as a dynamic phenomenon. To practitioners, the study motivates IS project managers to reflect on what influences and biases their views (or frames) of projects for better subsequent actions and provides new recommendations that can be incorporated into the project management training materials, such as the project management body of knowledge (PMBOK) guide.

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## Attestation of Authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

Abdelghany Salah

30/05/2023

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Signature

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Date

## List of Abbreviations

PMI	Project Management Institute
PMP	Project Management Professional
RM	Risk Management
IS	Information Systems
IT	Information Technology
PMO	Project Management Office
QDA	Qualitative Data Analysis
RPs	Reference Points
PMBOK	Project Management Body of Knowledge
GSD	Global Software Development

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This study was conducted in accordance with the Auckland University of Technology's (AUT) Code of Conduct for Research. Ethical approval (application no. 21/169) was granted by the AUT Ethics Committee (AUTECH) on July 9, 2021.

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## **Dedication**

To those whose unwavering love and support have guided me through this incredible journey, this thesis is dedicated.

To my parents, who instilled in me the values of hard work, perseverance, and the pursuit of knowledge. Your belief in me has been my North Star, guiding me through the darkest nights and the stormiest seas of my academic voyage.

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# Chapter 1: Introduction

## 1.1 Chapter Overview

This chapter provides an overview of this research. It starts with an overview of the background and context that frame this study. This is followed by the research problem, the statement of purpose, and the relevant research questions. In addition, this chapter includes a discussion of the research approach and the significance of the study. This chapter concludes with a discussion of the thesis' structure, including a brief description of each chapter.

## 1.2 Background and Context

Failure is a common feature of the field of information systems (IS) (Cecez-Kecmanovic et al., 2014; Iriarte & Bayona, 2020). According to the Chaos report by the Standish Group, only 16.2% of all software projects were successful in that they were completed on time, within budget, and with all desired features; 52.7% were over time and budget and lacked desired features; and 31.1% were deemed unsuccessful because they were abandoned (Johnson, 2020). Moreover, software projects that fail incur enormous costs. According to the Cost of Poor Quality Software report, \$130 billion is lost annually in the United States due to troubled projects, \$47.5 billion is lost due to cancelled projects, and \$2.84 trillion is lost due to poor-quality software (Krasner, 2018).

In many studies, poor risk management is among the main reasons for the failure of software projects (e.g., Aranyossy et al., 2018; Hughes et al., 2017). Previous research indicates that software project failures are caused in part by IS project managers who fail to adequately identify, evaluate, and monitor risks that can and frequently do materialise (Keil & Lee, 2019; Tamburri et al., 2021). It is worth noting that risk is an abstract concept. It refers to the potential realisation of undesirable consequences of an event (Bannerman, 2008). Risks are often grouped; for example, it is common to classify risks based on their sources, such as organisational environment, users, system requirements, planning and control, and team. (Wallace & Keil, 2004).

In order to further explore the issue of software project failure, a real-life example of ineffective risk management is provided (Oberg, 1999). NASA designed and launched the Mars Climate Orbiter probe to explore the climate, atmosphere, and surface of Mars. Communication with the space probe was permanently lost nine and a half months after its launch. This resulted in a \$125 million loss for NASA. According to an investigation report, this failure was caused by a software error resulting from inadequate risk management (Stephenson et al., 2000). Identifying and controlling risks, therefore, is considered by both practitioners and researchers as an important tool for ensuring the success of software projects.

Risk management can be defined as a group of principles and practices that aim to identify, assess, and manage risk factors in order to increase the likelihood of project success and avoid failure (Boehm, 1991). Risk management has been identified as one of the most important factors influencing the success of software projects (e.g., Gheni et al., 2017; Masso et al., 2020; Reed & Angolia, 2018). The importance of managing risks led to a stream of research beginning in the 1970s on IS project risk management (Bannerman, 2008). Currently, there are two main bodies of knowledge in IS project risk management: normative knowledge and experiential knowledge (Moeini & Rivard, 2019b). Normative knowledge focuses on developing formal prescriptions to guide IS project managers on how they should manage project risks. Experiential knowledge, on the other hand, focuses on how risks are actually managed, and this knowledge is captured by academics who search for sense in behaviour (Moeini & Rivard, 2019b).

### **1.3 Research Problem**

Much of the prior research on IS project risk management has focused on developing normative prescriptions, including risk checklists (e.g., Addison, 2003; Menezes et al., 2019; Verner et al., 2014), risk frameworks (e.g., Chadli & Idri, 2017; Wallace & Keil, 2004), process models (e.g., Boehm, 1991; PMI, 2017), and risk mitigation strategies (e.g., Nidhra et al., 2013; Yogi & Patil, 2018). Moreover, these prescriptions have received empirical support from many studies for their efficacy (e.g., de Bakker et al., 2012; McGrew & Bilotta, 2000; Ropponen & Lyytinen, 2000). However, risk management researchers have long stressed that IS project managers do not always use these prescriptions (e.g., Papke-Shields et al., 2010; Varajão et al., 2017). A recent study (Reed & Angolia, 2020) showed that only 52% of IS project managers performed all formal steps of risk management (i.e., risk identification, risk analysis, risk response and risk monitoring) in their projects. This deficiency was also stressed by the PMI (2019), which found that 27% of surveyed organisations reported that they do not “always” use risk management practices.

Furthermore, research evidence indicates that the assumptions underlying many risk management prescriptions differ from the way IS project managers view risk and respond to it (Keil & Lee, 2019; Kutsch et al., 2013; Moeini & Rivard, 2019b). For example, many past studies assume that IS project managers will follow prescribed risk management practices, objectively assess risk factors and enact risk responses (Boehm, 1991). These are far from the observations showing that IS project managers frequently disengage from formal risk management practices (Kutsch et al., 2013), focus only on a few risk factors (Moynihan, 2002), and decide upon risk responses based on their risk perception (Moeini & Rivard, 2019a). In addition, Taylor (2006) asserts that IS project managers do not follow risk-by-risk response planning as outlined in the formal risk management prescription but rather apply general mitigation strategies against all identified risks.

The above discussion suggests that there is a gap between risk management prescriptions and practice. This gap can be seen from two perspectives: (1) the extent to which IS project managers do not use formal prescriptions, and (2) the extent to which these prescriptions are difficult to implement in practice. Additionally, there appears to be a significant body of literature on what IS project managers should do, instead of what they actually did. In a recent review article, Moeini and Rivard (2019b) asserted that there are few studies attempting to explain why IS project managers deviate from formal risk management prescriptions. As long as there is a gap between risk management prescriptions and practice, the acceptance of these prescriptions is at stake. Therefore, advancing experiential knowledge of risk management contributes to the development of more reliable normative prescriptions, thereby enhancing their acceptability.

#### **1.4 Statement of Purpose and Research Questions**

While there is a large body of literature describing what IS project managers should do, little is known about what they actually do. The purpose of this study is to advance experiential knowledge of IS project risk management; the aim is to understand how IS project managers engage in risk management activities and why they sometimes deviate from formal prescriptions. To achieve this purpose, prospect theory (Tversky & Kahneman, 1981) is used as the main theoretical framework that guides this study. Prospect theory provides two main concepts of interest: framing and reference point.

The concept of framing states that people may become biased towards one option when making a decision due to the way the information is framed. There are a variety of framing types, which vary in terms of what is framed and what is affected (Levin et al., 1998), such as risky choice framing, goal framing, attribute framing, project framing. In risky choice framing, a potential choice involving options with varying risk levels depends on whether the outcomes of these options are framed positively or negatively. In goal framing, the rate of adopting a behaviour depends on whether the positive or negative consequences of the behaviour in relation to a particular goal are emphasised. Attribute framing includes evaluating an object based on its attributes or characteristics, which are positively or negatively framed. For example, in a study of attribute framing (Karevold & Teigen, 2010), it was found that project managers were less willing to continue with a troubled project when its progress was described in terms of the amount of work left (a negative frame) instead of the amount of work done (a positive frame).

Project framing is another framing type that is particularly important to this study. Project framing can be defined as the perception or attitude that an IS project manager has about a project (Benschop et al., 2011); It entails the analysis and simplification of project-related information, such as that presented in business cases. In essence, IS project managers can develop or describe their project framing using any of the three types of framing described previously: risky choice

framing, goal framing, or attribute framing. Therefore, this study proposes that IS project managers' project framing influences how they engage in risk management.

Furthermore, this study suggests that project-related information lacks meaning by itself because, for example, it contains absolute values such as the project budget and duration; it needs to be compared to other information (i.e., reference points) in order to be meaningfully interpreted. For instance, when evaluating the allocated budget for a project, a project manager may compare this value to the budget of a similar previous project (i.e., the reference point) in order to determine whether the budget is tight or sufficient. Reference points can be defined as the comparative standards against which other objects are evaluated or measured (Tversky & Kahneman, 1981). Therefore, this paper proposes that project managers interpret project-related information (i.e., project framing) using various reference points.

Consequently, this study seeks to address the two primary research questions listed below:

- How do IS project managers develop the framing of a project?
- How does IS project managers' project framing influence their engagement with risk management?

## **1.5 Research Approach**

A research approach can be quantitative, qualitative, or mixed methods (Creswell, 2014). Since this study aimed to investigate how project framing influences risk management engagement from the perspective of IS project managers, a qualitative approach was the preferred research approach for this study. A qualitative approach is appropriate when the goal is to understand the phenomenon of interest from the participants' perspectives (Merriam & Tisdell, 2015). Qualitative research is an umbrella term that includes a variety of qualitative research approaches. There are five common qualitative research approaches: narrative research, phenomenology, ethnography, ground theory, and case study (Creswell, 2018).

The case study methodology was selected for this study. This selection is based on Yin's (2018) argument that case studies are suitable when: (1) research questions are "how" or "why" questions; and (2) the focus is on studying contemporary events in a real-life context. First, the form of this study's research question is a "how" question; specifically, "How does project managers' project framing influence their engagement with risk management?" Second, this study investigates this issue using examples of recent projects undertaken in IT/IS companies; thus, the phenomenon involves studying contemporary events in a real-life context. The case study concerns an IS project manager's approaches and experiences regarding how a project framing develops and impacts risk management engagement. A multiple-case design was chosen because it allows for capturing different project managers' perspectives and performing cross-case analysis. Cases were purposefully selected based on predetermined criteria: project managers

must currently work in the IT/IS industry and have at least 3 years of experience in managing risk. In addition, maximum variation and snowball sampling strategies were adopted to identify cases with diverse characteristics (e.g., position and education) and obtain referrals to other potential participants.

Semi-structured interviews were the primary method used for collecting the data. Semi-structured interviews were chosen because they give the researcher more control over the interview's topics than unstructured interviews (Given, 2022), but unlike structured interviews, they give participants a great deal of leeway in answering (Bryman & Bell, 2015). Semi-structured interviews were conducted with project managers in various IT/IS companies in New Zealand. A total of 26 interviews were conducted, each interview had taken approximately 1.5 hours in duration. Out of 26 interviews, 7 were conducted face-to-face and 19 were conducted online via Zoom or Google Meeting. All interviews were recorded and transcribed.

The interview data was analysed using the template analysis style of thematic analysis (King et al., 2018). Template analysis was suitable for this study because it enables the use of *a priori* themes to guide the analysis while allowing for inductive themes to emerge from the data. The main steps conducted in the template analysis are as follows: (1) identifying *a priori* themes in advance of coding; (2) selecting and familiarising with a subset of the data; (3) coding the data; (4) creating an initial coding template; and (5) applying the template to further data and modifying it until a final version of the template is developed. In addition, the MAXQDA software was used to facilitate the analysis process.

## **1.6 Significance of the Study**

This study provides both theoretical and practical contributions. In the aspect of theoretical contributions, this study extends our understanding of IS project risk management and prospect theory. First, this study addresses the main limitation of previous framing studies; that is, the focus was mainly on how people react to externally framed decision-making information (Yu et al., 2015). This approach to framing can be referred to as “imposed framing”. Imposed framing, in which frames are created by experimenters, is characterised by the inability to describe how decision makers interpret and code decision-making information in real-world situations (Yu et al., 2015). Therefore, this study adds to the existing framing studies by taking a different approach called “subjective framing”. Subjective framing describes how decision makers spontaneously interpret and frame decision-making information. Peng et al. (2021) indicated that in order to predict people's behaviour, researchers should first understand how they interpret decision-making information.

Second, this study extends our understanding of IS project risk management by showing how the initial framing of IS projects affects project managers' engagement in risk management. Gaining

insight into a project manager's project framing is useful since it can be indicative of his or her risk perception in the project (Benschop et al., 2011). It is also suggested that project framing involves the rationale or argument that justifies pursuing a particular course of action (Mähring & Keil, 2008). Prior research has shown that the initial framing of IS projects can promote project escalation (Mähring & Keil, 2008) or bias the decision-makers towards investing in new IS projects (Benschop et al., 2011). Thus, analysing project managers' project framing can improve our understanding of their behaviour and decision-making in managing risk.

In the aspect of practical contributions, prior research indicates that software project failures occur, in part, because project managers often fail to adequately manage project risks that can and often do materialise (Keil & Lee, 2019). One explanation of this issue is that the project frames that are subjectively developed by IS project managers could lead them to form an unrealistically optimistic perception of the project and, in turn, tend to underestimate the risks associated with it. Therefore, this study should motivate IS project managers to reflect on what influences and biases their views (or frames) of projects, as self-awareness may help in developing better frames and, in turn, better subsequent actions in projects. Furthermore, this study's findings can be incorporated into project management training materials. For example, the project management body of knowledge (PMBOK) guide acknowledges that, as each project is unique, the application of risk management should be tailored (PMI, 2017). Thus, the attributes influencing IS project managers' perceptions of projects and their engagement in risk management can be viewed as considerations for tailoring the risk management processes.

## **1.7 Structure of the Thesis**

This thesis is organised into major five chapters. The following is a brief summary of each chapter.

*Chapter 1* provides an overview of the thesis, including the background and context of the study, the research problem, the purpose and research questions, the research methodology, the significance of the study, and finally the structure of the study.

*Chapter 2* introduces software projects, the concept of risk in general, and its specific meaning in IS literature. This chapter also explains the two main bodies of knowledge in IS project risk management, including normative knowledge and experiential knowledge. Furthermore, it discusses prospect theory, which is used as a theoretical framework for investigating the phenomenon under investigation.

*Chapter 3* describes the research methodology and specific procedures used to conduct this study. This includes (1) the philosophical assumptions underlying this study, (2) the chosen research approach and the rationale for this choice, (3) the research design, including sampling strategies and the role of theory, and (4) the methods used for data collection and analysis. This chapter also

explains the criteria used to establish this study's trustworthiness and the ethical considerations necessary for this study.

*Chapter 4* presents the key findings obtained from 26 interviews with IS project managers, where the interview data were analysed using the template analysis style of thematic analysis. This chapter begins by providing background information and case summaries for each participant. Following this, the findings are presented based on the final coding template created during the data analysis.

*Chapter 5* summarises the key findings of this study in relation to the research questions. This chapter also provides a detailed discussion of the findings in the context of the literature on behavioural IS risk management and framing effects. Finally, this chapter discusses the limitations of this study and suggests new avenues for further research.

## **Chapter 2: Literature Review**

### **2.1 Chapter Overview**

The aim of this study is to understand how IS project managers engage in risk management activities and why they sometimes deviate from formal prescriptions. To conduct this study, it was required to perform a critical review of the current literature. Therefore, this chapter is structured as follows: Section 2.2 introduces software projects and dominant project management approaches; Section 2.3 explains the concept of risk and its specific meaning in software development; Sections 2.4 and 2.5 discuss the two main bodies of knowledge in software project risk management, including normative knowledge and experiential knowledge; Section 2.6 explains prospect theory used as a theoretical framework for investigating the phenomenon under investigation; and the last section provides a brief concluding summary.

### **2.2 Software Projects**

The PMI's PMBOK Guide defines a project as a temporary endeavour undertaken to produce a unique product, service, or result (PMI, 2017). This definition includes two common characteristics of projects: uniqueness and temporariness. The temporary nature of a project implies that it has a definite beginning and end date (Axelos, 2017). A project is unique because it is not a routine operation but rather a collection of activities designed to attain a particular objective (PMI, 2017).

A software project is the collection of technical and managerial activities required to fulfill the terms of a project agreement (IEEE, 1988). A project agreement is a document signed by both the customer and the vendor that outlines the conditions under which the project will be executed; it can include the objectives, scope, staffing plan, requirements, price, timeline, budget, project deliverables, and acceptance criteria for project outcomes (IEEE, 1988). Thus, a software project should have beginning and ending dates, a schedule, a budget, and well-defined objectives (PMI, 2017). Typically, a software project is undertaken to build a new product, modify an existing one, or deliver operations support (PMI, 2013). In addition, software projects have characteristics that distinguish them from other types of projects, and these characteristics make the management of software projects particularly difficult (PMI, 2013; Ruhe & Wohlin, 2014). Table 1 presents some of the most important characteristics of software projects, organised into four dimensions: the intangible nature of the product, product complexity, project complexity, and a high level of uncertainty (PMI, 2013).

Table 1. Unique characteristics of software projects (Source: PMI, 2013)

<b>Dimension</b>	<b>Characteristics</b>
Intangible nature of product	<ul style="list-style-type: none"> <li>• Quantifying project objectives is difficult.</li> <li>• Measuring software quality is challenging.</li> <li>• Monitoring and controlling are difficult tasks.</li> </ul>
Product complexity	<ul style="list-style-type: none"> <li>• A software product can run on a variety of platforms and infrastructures.</li> <li>• Extensive software testing is impractical.</li> </ul>
Project complexity	<ul style="list-style-type: none"> <li>• Multiple stakeholders with potentially competing interests are involved.</li> <li>• Initial cost and schedule estimates are challenging.</li> </ul>
High level of uncertainty	<ul style="list-style-type: none"> <li>• Software requirements change as customer needs evolve.</li> <li>• Infrastructure and platform technologies evolve quickly.</li> </ul>

A project management approach is a set of principles and guidelines that define how a project is managed (Špundak, 2014). Currently, there are two main approaches to project management, including traditional and agile (Circic Lalic et al., 2022; Marnada et al., 2022). Each approach has unique characteristics. Table 2 compares traditional and agile approaches in terms of many dimensions, including the development life cycle, management style, documentation, team organisation, and customer involvement (Dyba & Dingsoyr, 2009; Moniruzzaman & Hossain, 2013; Nerur et al., 2005).

Table 2. Comparison of agile and traditional project management approaches (Source: Dyba & Dingsoyr, 2009; Moniruzzaman & Hossain, 2013; Nerur et al., 2005)

<b>Dimension</b>	<b>Traditional</b>	<b>Agile</b>
Development model	Linear sequence of steps Clear, largely stable, clearly defined	Emergent and iterative Emergent, rapid change, unknown
Management style	Process-centric, command-and-control	People-centric, leadership-and-collaboration
Documentation	Extensive and detailed	Light (replaced with face-to-face interaction)
Team organisation	Pre-structured teams	Self-organizing teams
Customer involvement	Low involvement	Active involvement, providing feedback

The traditional approach assumes that projects are simple, predictable, linear, and have well-defined boundaries, allowing for detailed planning and minimal deviation from the plan (Špundak, 2014). It aims to achieve optimization and efficiency by strictly adhering to the initial, detailed project plan (Shenhar & Dvir, 2007). In other words, the objective is to complete the project within the time, budget, and scope constraints (Wysocki, 2012). Thus, the traditional approach is process-centric and guided by the notion that sources of variation can be identified and eliminated through consistent measurement and enhancement of processes (Highsmith & Cockburn, 2001). The traditional approach depends heavily on processes, linear development cycles, and life cycle models such as the waterfall and spiral models (Aitken & Ilango, 2013). In

the traditional approach, a command-and-control style of management drives the development of a software product (Nerur et al., 2005). This approach is also characterised by generating extensive documentation that records process and product knowledge (Saynisch, 2010). Furthermore, customers have a vital role in the formulation of specifications, but their involvement in other activities is limited (Špundak, 2014).

Unlike the traditional approach, the agile approach is characterised by iterative development cycles driven by product features (Fitsilis, 2008). A project is divided into sub-projects that typically consist of planning, integration, testing, and product delivery. Each iteration results in working code that the client can use. According to the Agile Manifesto (2001), the four fundamental principles of agile development are as follows: 1) valuing the individual and the development team's interactions over the process and tools; 2) valuing working software over exhaustive documentation; 3) valuing collaboration with the customer over contractual negotiation; and 4) valuing the ability to respond to change over following a plan. Agile is an umbrella term that encompasses a variety of agile methodologies, including Scrum, Extreme Programming, Crystal, Feature-Driven Development, and Lean (Binder et al., 2014). In the agile approach, the leadership-and-collaboration management style is emphasized, with the project manager working as a facilitator or coordinator (Williams, 2005). Team members are given more discretion and decision-making authority, allowing them to self-organise and adapt rapidly to unexpected situations (Nerur et al., 2005). Moreover, customers actively participate in the development process by providing feedback that can lead to improved outcomes (Dingsøyr et al., 2012).

Both traditional and agile approaches have their strengths and weaknesses, so it is difficult to conclude that one is superior to the other (Nerur et al., 2005). However, it is sometimes recommended to combine the two approaches (Binder et al., 2014). The traditional approach is more suitable for projects with well-defined user requirements, clear project goals, and low levels of uncertainty (Coram & Bohner, 2005). Such projects often have a low rate of requirements change, and extensive end-user involvement is not required (Shenhar & Dvir, 2007). The traditional approach is also appropriate for projects that use stable technology and need formal documentation throughout the project's life cycle (Boehm, 2002). On the other hand, the agile approach is more suitable for projects with a high degree of uncertainty, unclear project objectives, and unpredictable requests (Conforto & Amaral, 2010; Špundak, 2014). Such projects are usually characterised by the need for constant modifications and updates to the project plan (Coram & Bohner, 2005). The agile approach is also useful for projects that have tight time constraints and require close and frequent collaboration with customers and end users (Boehm, 2002; Wysocki, 2012).

It has been frequently reported that the success rate of software projects is low (Cecez-Kecmanovic et al., 2014; Iriarte & Bayona, 2020). For instance, according to the Standish Group's Chaos report, only 16.2% of all software projects were successful in that they were finished on schedule, on budget, and with all desired features; 52.7% were over time and budget and lacked desired features; the remaining 31.1% were deemed unsuccessful because they were abandoned (Johnson, 2020). Inadequate risk management is often cited as one of the primary causes of software project failure (Aranyossy et al., 2018; Tamburri et al., 2021). Correct identification and monitoring of risks can therefore help to increase the success rate of software projects (Masso et al., 2020). In the next section, the concept of risk in general and its specific meaning in software projects are discussed.

### **2.3 Concept of Risk**

The etymology of the word "risk" is contested in the literature. Ansell and Wharton (1992) believe that the word "risk" could have originated from either the Arabic "risq" (meaning "anything granted by God for profit") or the Latin "risicum" (referring to a sailor's challenge from a reef). The Oxford English Dictionary suggests that risk originated in the 17th century from the Italian "risco", but Luhmann disputes this, asserting that the word first appeared in German references in the middle of the 16th century and that the Latin term "risicum" was in use prior to this (Lupton, 1999). Several scholars associate the term "risk" with early maritime ventures, and its origins may be in Portuguese or Spanish, where it means "to sail into uncharted waters" or "to dare" (Aven, 2012). Ewald believes that the concept of risk first emerged in the Middle Ages in the context of maritime insurance and designated voyage perils (Althaus, 2005). According to the British Medical Association, it is derived from the Greek word "rhiza", which means "hazards of sailing near cliffs" (Henderson, 1987).

Using the Oxford Advanced Learner's Dictionary (n.d.) to investigate the contemporary usage of the term "risk", the following three categories of risk definitions are identified:

- a) To do something that may cause an unpleasant or dangerous situation.
- b) The possibility that something bad may occur in the future; a situation that could be hazardous or have negative results.
- c) A person or thing that is likely to produce problems or danger in a particular respect.

Based on these definitions, the term "risk" can be considered either a verb (e.g., to risk losses) or a noun (e.g., taking risks). Obviously, the concept of risk is relevant not only to linguistics but also to other disciplines and fields. Thus, some researchers explained how risk is conceptualised and applied in various disciplines and application areas. Althaus (2005) distinguishes between the following disciplines: logic and mathematics, science and medicine, social sciences (economics, psychology, law, and sociology), history and humanities, religion, and philosophy. Aven and

Renn (2010b), on the other hand, distinguish between statistical analysis, toxicology and epidemiology, probabilistic risk analysis, economics of risk, psychology of risk, social theories of risk, and cultural theory of risk. For example, according to Althaus' classification (2005), logic and mathematics view risk as a calculable phenomenon, economics view it as a decisional phenomenon, and psychology views it as a behavioural and cognitive phenomenon. These classifications simplify how different disciplines and application areas view risk.

There exist many definitions of the risk concept in the scientific risk fields (Aven, 2012). It is difficult to present and discuss each of these definitions. However, the following are some common definitions of risk (Aven & Renn, 2010a, p. 2):

1. "Risk equals the expected loss".
2. "Risk equals the expected disutility".
3. "Risk is the probability of an adverse outcome".
4. "Risk is a measure of the probability and severity of adverse effects".
5. "Risk is the combination of probability and extent of consequences".
6. "Risk is equal to the triplet  $(s_i, p_i, c_i)$ , where  $s_i$  is the  $i^{\text{th}}$  scenario,  $p_i$  is the probability of that scenario, and  $c_i$  is the consequence of the  $i^{\text{th}}$  scenario,  $i = 1, 2, \dots, N$ ".
7. "Risk is equal to the two-dimensional combination of events/consequences and associated uncertainties".
8. "Risk refers to uncertainty of outcome, of actions and events".
9. "Risk is a situation or event where something of human value (including humans themselves) is at stake and where the outcome is uncertain".
10. "Risk is an uncertain consequence of an event or an activity with respect to something that humans value".

These definitions capture the essence of several definitions found in the literature (Aven et al., 2011). Further, they can be divided into two categories that illustrate the various ways that the concept of risk is currently viewed: definitions based on probabilities and expected values and definitions based on events, consequences, and uncertainties (Aven & Renn, 2010a).

The literature on software risk employs a variety of risk conceptualisations (Alter & Sherer, 2004; Moeini & Rivard, 2019b). These conceptualisations fall into three categories: risk components, risk factors, and risk perception. Table 3 summarises these different risk conceptualisations as well as the cited studies.

Table 3. Risk conceptualisations in the literature on software risk

<b>Risk conceptualisations</b>	<b>How it views risk</b>	<b>Examples of cited studies</b>
Risk components	Risk as negative outcomes (e.g., functionality risk, political risk, or security risk).	Alter and Sherer (2004), Benaroch (2002), Viehland (2002)
Risk factors	Risk as a serious threat to the completion of a software project.	Menezes et al. (2019), Hoodat & Rashidi (2009), Addison (2003), Schmidt et al. (2001)
Risk perception	Risk as a belief that risk sources may affect project outcomes.	Moeini and Rivard (2019b), Kutsch et al. (2013), Liu et al. (2009), Keil et al. (2002)

The first conceptualisation of risk defines risk as risk components representing different types of negative outcomes. Examples of risk components include functionality risk (failure to deliver desired functionality), project risk (failure to complete a project on time, within budget, and/or with required quality), security risk (negative consequences of insecure systems), or political risk (negative consequences of a shifting power balance between users) (Alter & Sherer, 2004).

The second conceptualisation of risk views risk as risk factors, which is a condition that can present a serious threat to the completion of a software project (Coyle & Conboy, 2009). Examples of risk factors are inadequate planning, unclear project objectives, unrealistic schedule, and scope changes (Menezes et al., 2019). Furthermore, risk factors are often grouped based on their source (e.g., users, system requirements, project complexity, or team) (Wallace et al., 2004), or project phases (e.g., planning, analysis, design, implementation, testing, and maintenance) (Lam, 2004).

The third conceptualisation of risk is perceived risk (or risk perception). Risk perception can be defined as “the belief that there exist sources of risk with potential to adversely affect project outcomes” (Du et al., 2007, p. 272). Thus, the risk perception of IS project managers diverge from the normative definition of risk exposure, which accounts for both the probability of occurrence and the impact of risks (Moeini & Rivard, 2019b). First, they focus on the impact of risks rather than their probability of occurrence (Schmidt et al., 2001). Second, risk perception includes additional dimensions such as uncontrollability, lack of information, and the timing of loss occurrence (Keil et al., 2000). Consequently, this study adopts the definition of “risk perception” and concludes that project managers have different risk perceptions.

## **2.4 Risk Management in Software Projects**

Software project risk management can be defined as a group of principles and practices that aim to identify, assess, and manage risk factors in order to increase the likelihood of project success and avoid failure (Boehm, 1991; Kerzner, 2017). Its primary goals are to increase confidence in achieving project objectives, align understanding among stakeholders, improve the ability to

make quality decisions, and prevent duplication of effort (Bannerman, 2008; Willumsen et al., 2019).

In a number of studies, risk management has been identified as one of the most important factors influencing the success of software projects (e.g., Gheni et al., 2017; Liu et al., 2009; Reed & Angolia, 2018). This success will depend heavily on the expertise and skills of the risk managers and project managers (Masso et al., 2020), as well as the perceptions and expectations of stakeholders and the coordination of actions designed to mitigate risks (de Bakker et al., 2011). At the same time, poor risk management is among the main reasons for the failure of software projects (Aranyosy et al., 2018; Hughes et al., 2017; Tamburri et al., 2021). According to a recent report by the PMI (2019), poor risk management is still a significant factor in project failure. In this report, the PMI also emphasizes that the use of standardised project management practices can reduce risk and improve outcomes.

Currently, there are two main bodies of knowledge in software project risk management: normative knowledge and experiential knowledge (Moeini & Rivard, 2019b). Normative knowledge focuses on developing formal prescriptions to guide IS project managers on how they should manage project risks (Moeini & Rivard, 2019b). Over the past years, many risk management prescriptions have been advanced in practitioner-oriented journals (Nelson, 2008), and included in project management training materials such as PMI's PMBOK (PMI, 2017). In contrast, experiential knowledge focuses on how risks are actually managed, and this knowledge is captured by academics who search for sense in behaviour (Moeini & Rivard, 2019b). Normative prescriptions of risk management can take the form of risk checklists, risk categories or frameworks, process models, and risk response strategies (Bannerman, 2008). Each one is briefly reviewed in the following subsections.

#### **2.4.1 Risk checklists**

Several risk checklists for software projects have been developed in the literature. The main benefit of risk checklists is that they provide a quick and cost-effective method for identifying and assessing the risks of a project (Bannerman, 2008). Some lists are applicable to most software projects (Addison, 2003; Barki et al., 1993; Boehm, 1991; Hoodat & Rashidi, 2009; Menezes et al., 2019; Schmidt et al., 2001), while others are tailored to specific project types, such as global software development (GSD) projects (Chadli et al., 2016; Verner et al., 2014), distributed agile projects (Shrivastava & Rathod, 2015), and enterprise resource planning (ERP) projects (Huang et al., 2004; Scott & Vessey, 2002), as well as specific countries (Mursu et al., 2003). Typically, these lists are generated using the Delphi method, surveys, or systematic literature reviews. Table 4 shows examples of risk factors found in the literature.

Table 4. Examples of risk factors found in the literature

<b>Risk factors</b>	<b>Project type</b>	<b>Source</b>
Failure to get project plan approval from all parties Failure to manage end-user expectations Lack of effective project management skills Unclear or misunderstood scope New or unfamiliar subject matter for both users and developers Lack of required knowledge/skills in the project personnel Introduction of new technology Lack of control over consultants, vendors, and subcontractors	General	(Schmidt et al., 2001)
Bad commitment of the user/customer Requirement changes Unrealistic schedule Unstable organisational environment No planning or inadequate planning Ineffective communications between team members Development methodology was inappropriate for the project Lack of top management commitment/support to the project	General	(Menezes et al., 2019)
Language and terminology differences between development sites Inability to communicate in real-time Different time zones and limited face-to-face interaction Different programming languages and development tools Cultural diversity between development sites or teams	Global software development	(Chadli et al., 2016)
Requirements conflicts among multiple product owners Inadequate prioritization of requirements Cross-functional teams insufficient for testing of large projects Ineffective stand-up meetings Unavailability of product owner Poor communication skills in the team members Lack of trust between onshore and offshore team Inappropriate user story estimates by multiple vendors	Distributed agile projects	(Shrivastava & Rathod, 2015)
Attempting to build bridges to legacy applications Unable to comply with the standard which ERP Lack of analysts with business and technology knowledge Fail to redesign business process Failure to support cross-organisation design Conflicts between user departments Lack of senior manager commitment to project Insufficient training of end-user	Enterprise resource planning	(Huang et al., 2004)

#### 2.4.2 Risk categories and frameworks

Risk categories (also known as risk dimensions) can provide a more comprehensive framework for thinking about what risks might threaten a project than simply working through a predetermined checklist of risks (Bannerman, 2008). In addition, risk control strategies can be applied effectively to one or more risk categories as a whole rather than treating each risk factor individually (Addison & Vallabh, 2002). Several risk categories and frameworks have been suggested in the literature.

The frameworks that classify risks according to their source are the most prevalent. For example, Wallace et al. (2004) classify risks into six dimensions: organisational environment, user, requirements, project complexity, planning and control, and team. The Project Management

Institute (PMI) divides risks into five categories: external-unpredictable, external-predictable, internal (non-technical), and technical (PMI, 2017). According to the Software Engineering Institute’s risk taxonomy, risks can be classified as product engineering, development environment, and programme constraints (Carr et al., 1993).

Risks are also classified according to the project’s life-cycle phases. Lam (2004), for instance, proposed a framework that categorises risks according to the phases of enterprise integration projects, specifically the strategy, planning, implementation, and rollout phases. Roy et al. (2016) proposed a software risk classification in which risks are categorised based on the stages of the software development life cycle (requirements, planning, design, implementation, deployment, and maintenance). This classification will assist project managers in addressing risks at the stage in which they are identified, rather than waiting until the final stage to do so.

Another classification of risks is based on perceptions, such as the perceived importance of the risk and the perceived level of the project manager’s control (Wallace & Keil, 2004). Based on these two dimensions, as shown in Figure 1, there are four risk categories: customer mandate, scope and requirements, execution, and environment. Customer mandate (Quadrant 1) is concerned with risks related to customers and users. Scope and requirements (Quadrant 2) focus on risks related to a project manager’s inability to define a system’s scope correctly. Execution (Quadrant 3) focuses on risks related to carrying out software development activities. Finally, environment (Quadrant 4) focuses on risks associated with the internal and external environments where the project exists. Risks in Quadrants 2 and 3 are perceived as being under the project manager’s control, whereas risks in Quadrants 1 and 4 are typically beyond the project manager’s control.

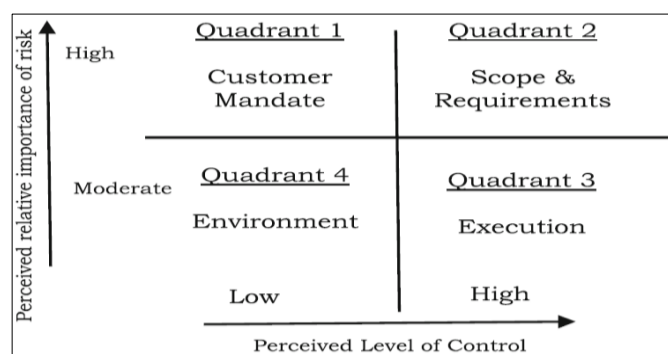


Figure 1. Risks categorization (Wallace & Keil, 2004)

Categorisation can also be performed using theories such as Leavitt’s (1962) organisational change model, which consists of four components: task, actor, structure, and technology.

Consequently, Lyytinen et al. (1998) used this model as a framework to define risks in software development and defined the components as follows: task covers the software project's results, products, approaches, and objectives; structure represents the project organisation and other institutional arrangements; actors involve users, managers, developers, and other key stakeholders; and finally, technology includes development methods and tools, as well as the hardware and software platforms for the resulting software. In addition, Chadli and Idri (2017) used this framework to identify and classify risk factors in the context of global software development.

Furthermore, there are proposed risk categories for particular types of projects. For example, Shrivastava and Rathod (2015) identified five categories of risk factors for distributed agile projects, including the software development life cycle, project management, group awareness, external stakeholder collaboration, and technology setup. Also, Scott and Vessey (2002) developed a framework of risk factors for ERP projects, which is comprised of four categories: the external business environment, organisational context, system context, and project.

### **2.4.3 Process models**

Process models specify the activities deemed essential for managing risk in software projects; in addition, they specify the order in which these activities should be performed in order to effectively manage risk and recommend tools and techniques for each activity (Bannerman, 2008). The majority of models include a similar set of activities, such as risk identification, risk analysis, risk responses, and risk control (Masso et al., 2020). Boehm (1991) and the PMBOK Guide by PMI (2017) are the two most dominant models in software engineering. Other influential models include the ISO 31000 standard, the Microsoft Solutions Framework (MSF), the Capability Maturity Model Integration (CMMI), and the Rational Unified Process (RUP) (Masso et al., 2020). This study follows the process of risk management described in the PMI's PMBOK (2017) for several reasons. PMI is the largest project management organisation in the world, and its standards have gained worldwide exposure and recognition (Chaouch et al., 2019). In addition, PMBOK provides a more comprehensive description of risk management processes, including tools, techniques, inputs, and outputs (Varajão et al., 2017). Each activity in the risk management process, as outlined in the PMBOK guide, is described in the following subsection.

#### **2.4.3.1 Risk planning**

Risk planning is the process of determining how to carry out risk management activities for a project. It ensures that the level, type, and visibility of risk management correspond to the project's risks and organisational importance (PMI, 2017). The process of risk planning entails developing an effective strategy to address the most significant risks while optimising the allocation of project resources (Hussain, 2019). Tools and techniques used in risk planning

include analytical techniques (e.g., stakeholder analysis) to understand and define the overall risk management context of the project, expert judgement from specialised individuals such as senior management, project stakeholders, and subject matter experts, and meetings to develop the risk management plan, assign responsibilities, and customise it for the project (PMI, 2017).

A significant output of the risk planning process is a document known as a risk management plan. It describes the structure and execution of risk management activities (Kerzner, 2017). A risk management plan should encompass the following elements: the roles and responsibilities of risk management team members; the funds required to execute risk management tasks; the frequency and timing of risk management procedures throughout the project life cycle; the risk categories for grouping potential project risks; the risk probability and impact levels appropriate for the project context; the risk appetite of key project stakeholders; and the format and content of the risk register and any additional risk-related reports (PMI, 2017).

#### **2.4.3.2 Risk identification**

Risk identification is the process of identifying potential risks that may influence the project and documenting their characteristics (Masso et al., 2020). To identify risks, a variety of tools and methods can be used. Brainstorming is used to create an extensive list of project risks with the help of a facilitator and a multidisciplinary team (PMI, 2017). The Delphi technique is used to reach a consensus among experts on critical project risks using anonymous questionnaires (Hussain, 2019). SWOT analysis examines the project from the perspectives of its strengths, weaknesses, opportunities, and threats in order to broaden the scope of identified risks (PMI, 2017). Checklist analysis is used to identify risks based on historical data and knowledge from similar past projects (Ahmed et al., 2007). Expert judgement entails experts with relevant experience with similar projects or business areas directly identifying risks; however, experts' bias must be considered (PMI, 2017). Assumptions analysis identifies the risks associated with the inaccuracy, instability, inconsistency, or incompleteness of the assumptions upon which the project management plan is based (Kerzner, 2017). The primary output from the risk identification process is the risk register. The risk register contains a list of identified risks with detailed descriptions, their root causes, and potential owners (PMI, 2017).

#### **2.4.3.3 Risk analysis**

Risk analysis is the process of assessing the likelihood and impact of identified risks in order to determine their overall level of exposure (PMI, 2017). Risks are then prioritised depending on their exposure, which aids in the development of appropriate risk response strategies (Hussain, 2019). Risk exposure is calculated using either a qualitative or quantitative risk analysis approach. The most prevalent form of qualitative approach is combining the probability and impact of risks to create a risk matrix (Boehm, 1991). In contrast, quantitative approaches such as expected value

calculations, decision tree analysis, sensitivity analysis, and Monte Carlo simulation are also commonly used (PMI, 2017).

#### **2.4.3.4 Risk response**

Risk response is the process of developing options and actions for handling risks. The key benefit of this process is that it addresses risks according to their importance and allocates the required tasks and resources to the project's budget, timeline, and management plan (PMI, 2017). Risk response planning includes selecting the best response options and implementation approaches for identified risks, often known as the "risk response strategy" (Kerzner, 2017). There are four main risk response options: Avoiding risk that involves taking actions to eliminate the risk or protect the project from its consequences, such as modifying the project plan or reducing scope; mitigating risk that involves taking actions to reduce the likelihood of occurrence or impact of a risk; transferring risk that involves outsourcing the ownership of a risk to a third party that can manage the risk outcome; and accepting risk that involves recognising the risk and refraining from taking action until the risk materialises (PMI, 2017).

As a result of the risk response process, some project documents, such as the risk register, may be updated (Patterson & Neailey, 2002). Updates to the risk register may include information on risk owners and their responsibilities, response strategies, specific actions to implement the chosen strategies, budget and schedule activities required to implement those actions, trigger conditions and warning signs of risk occurrences, contingency plans, and residual or secondary risks that arise from implementing a response (PMI, 2017).

#### **2.4.3.5 Risk monitoring and control**

Risk monitoring and control is the process of continuously monitoring the implementation of risk response strategies, tracking identified risks, identifying new risks, and assessing the efficacy of the risk management process (PMI, 2017). The purpose of this process is to ensure the effectiveness of risk mitigation strategies and to record the lessons learned from their implementation (Masso et al., 2020). There are various tools and techniques that can be used in risk monitoring. These include technical performance analysis that compares actual results to targets; reserve analysis that compares remaining contingency reserves to remaining risk; and audits that evaluate the efficacy of the risk management process (PMI, 2017). Risk reviews can also be used to identify new risks, reassess existing risks, and identify lessons learned for future projects (Kerzner, 2017).

#### **2.4.4 Mitigation strategies**

The literature also suggests mitigation strategies to assist project managers in mitigating the effects of risks associated with the management of software projects. Typically, risk mitigation strategies aim to reduce or eliminate the probability of risks occurring or minimize their impact

if they occur (Bannerman, 2008). Risk mitigation strategies have been proposed for software projects in general (Abdul-Rahman et al., 2012; Tesch et al., 2007; Yogi & Patil, 2018); for specific types of projects such as GSD projects (Chadli & Idri, 2017; Nidhra et al., 2013; J. Verner et al., 2008) and distributed projects (Persson & Mathiassen, 2010); and for specific types of risks such as technological risks (Dantas et al., 2022). These mitigation strategies were gathered through systematic literature reviews or interviews with software project professionals. Furthermore, such mitigation strategies are grouped into fewer categories in order to make them more manageable. Verner et al. (2008), for instance, grouped the mitigating strategies into four categories including GSD outsourcing rationale, software development process, human resources, and project management. Nidhra et al. (2013) classified the mitigating strategies as personnel, project, and technology. Table 5 shows examples of risk mitigating strategies found in the literature.

Table 5. Examples of risk mitigation strategies found in the literature

Mitigation strategies	Project/risk type	Source
Greater degree of users' involvement and commitment Developed clear and detailed requirements Thorough analysis of development methodology Use of project tracking system and regular updating Consistent commitment of management Set key performance indicators and standards for stages Proper project planning and scheduling Conduct a thorough analysis feasibility study	General	(Abdul-Rahman et al., 2012)
Involving professionals from the academy in the project team Brainstorming sessions with different professionals Prototype considering how to develop the system Bringing a client to join the team Constant communication and running multiple testing sessions Applying configuration management techniques Creating simulation scenarios together with the customer Using tools to simulate desirable behaviours in the system	Technological risks	(Dantas et al., 2022)
Understand the language and business culture of clients Travel to client location for establishing friendly ties Schedule additional weekly meetings to fill knowledge gap Using a configuration management system Implement mentoring and shadowing Conduct cultural workshops Frequent milestones and detailed status reports Map business terms to logical entities	Global software development	(Nidhra et al., 2013)
Divide tasks systematically between sites Reduce time-zone differences Establish shared control mechanisms Improve capability to manage cultural differences Develop liaisons between sites Standardize and train in methods across sites Adopt appropriate communication technologies	Distributed projects	(Persson & Mathiassen, 2010)

#### **2.4.5 Limitations of normative knowledge in risk management**

Most studies relevant to the normative body of knowledge have focused on developing formal prescriptions for project managers on how to manage risks. Such prescriptions include risk checklists, risk categories or frameworks, process models, and risk response strategies. Further, these prescriptions have received empirical support from many studies for their efficacy (e.g., de Bakker et al., 2012; McGrew & Bilotta, 2000; Ropponen & Lyytinen, 2000). However, risk management researchers found that IS project managers do not widely use these prescriptions (Kutsch et al., 2013; Kutsch & Hall, 2009; Moeini & Rivard, 2019b; Papke-Shields et al., 2010; Varajão et al., 2017). A recent study (Reed & Angolia, 2020) showed that only 52% of IS project managers performed all formal steps of risk management (i.e., risk identification, risk analysis, risk response, and risk monitoring) in their projects. This deficiency was also stressed by the PMI (2019), which found that 27% of surveyed organisations reported that they do not “always” use risk management practices.

Moreover, research evidence indicates that the assumptions underlying many risk management prescriptions differ from the way project managers view risk and respond to it (Keil & Lee, 2019, 2019; Kutsch et al., 2013; Moeini & Rivard, 2019b). For example, many past studies assume that IS project managers will follow prescribed risk management practices, objectively assess risk factors and enact risk responses (Boehm, 1991). These are far from the observations showing that IS project managers frequently disengage from formal risk management practices (Kutsch et al., 2013), focus only on a few risk factors (Moynihan, 2002), and decide upon risk responses based on their risk perception (Moeini & Rivard, 2019a).

Therefore, more research is required to examine the behaviour and judgement of IS project managers in managing project risks (Lee et al., 2019). Consequently, this study focuses on advancing experiential knowledge of software project risk management; the aim is to understand how IS project managers engage in risk management activities and why they sometimes deviate from formal prescriptions. In the following section, an overview of the studies adopting an experiential perspective will be presented.

#### **2.5 Experiential Research on Software Project Risk Management**

This section discusses experiential (or behavioural) research on software project risk management. Experiential studies focus on how risks are actually managed and are conducted by academics who search for sense in behaviour. To identify the relevant studies, the approach recommended by Webster and Watson (2002) was followed. First, the online databases (EBSCOHost and ProQuest) were searched for the term “risk management” in the abstracts of papers published between 2010 and 2023 in the AIS Senior Scholars’ basket of eight journals. This resulted in 282 studies. After applying the inclusion/exclusion criteria, eight studies were

retained. The study must be written in English, focus on the behaviour and decision-making of project managers in managing software risks, and be concerned with project risks but not, for instance, business risks associated with the delivered system. Second, a backward search was conducted by reviewing the citations for each retained study. Third, a forward search was done using Google Scholar to identify papers citing the key studies identified. As a result, 11 additional studies were included in the review. Table 6 presents an overview of the selected studies.

Table 6. Experiential studies on IS project risk management

<b>Study</b>	<b>Methodology</b>	<b>Objective</b>
Lee et al. (2019)	Quantitative	To examine the effect of project managers' mental construal on risk management activities.
Moeini and Rivard (2019a)	Quantitative	To develop and test a model that explains and predicts project managers' risk response decisions.
Moeini and Rivard (2019b)	Conceptual	To develop a theoretical model of the factors influencing the relative performance of deliberate analysis and intuition in risk management.
Nuijten et al. (2018)	Quantitative	To investigate the differences between IT auditors' and IT managers' perceptions of risk.
Liu and Chiu (2016)	Quantitative	To investigate the impact of pre-project partnering on risk perception during IS development.
Liu and Yuliani (2016)	Mixed method	To examine the differences between client managers' and vendor managers' perceptions of IT outsourcing risks.
Shalev et al. (2014)	Quantitative	To study the effect of mental construals (both abstract and concrete) on optimism bias in project risk management.
Kutsch et al. (2013)	Qualitative	To investigate why project managers disengage from formal risk management practises and identify the key beliefs that influence their attitudes and actions.
Jani (2011)	Quantitative	To investigate how self-efficacy and risk factors (both endogenous and exogenous) influence project managers' perception of risk.
Kutsch and Hall (2010)	Qualitative	To investigate the reasons why certain known risks are deemed irrelevant.
Kutsch and Hall (2009)	Mixed method	To identify the factors that reduce the likelihood of implementing formal risk management.
Liu et al. (2009)	Mixed method	To compare the risk perceptions of senior executives and project managers
Keil et al. (2008)	Quantitative	To study the influence of risk checklists on risk perception and decision-making.
Du et al. (2006)	Quantitative	To examine the effect of three different factors on risk perception: the individual's expertise, the project's perceived control, and the use of an attention-shaping tool.
Taylor (2006)	Qualitative	To examine the strategies used by project managers to address project risks.
Kutsch and Hall (2005)	Qualitative	To determine the intervening conditions that cause project managers to deny, avoid, delay, and ignore dealing with risk.
Addison (2003)	Mixed method	To investigate the risks associated with the development of e-commerce projects from the perspectives of developers, project managers, clients and users, and academics.

Mursu et al. (2003)	Mixed method	To compare a ranked list of risk factors in Nigeria with ranked lists of risk factors from various socioeconomic contexts.
Keil et al. (2002)	Mixed method	To understand the differences in how project managers and users perceive project risks.

Some studies investigated the reasons why project managers do not apply formal risk management practices or disengage from these practices. For example, Kutsch and Hall (2005) conducted interviews with 19 IT project managers from eleven companies to determine the “intervening conditions” in risk management; that is, the conditions that result in project managers’ denial, avoidance, delay, and ignorance of uncertainty. Denial of uncertainty is necessary to avoid jeopardising the relationship with stakeholders and present the project as certain and successful. Avoidance of uncertainty is caused by a lack of trust or belief in the accuracy of risk-related information. Delay of uncertainty is due to a lack of interest or different risk management preferences (active or reactive) among stakeholders. Ignorance of uncertainty results from an unwillingness or inability to scan and interpret the surrounding environment. In similar vein, Kutsch and Hall (2010) conducted a qualitative study of IT project managers to determine why they deemed certain known risks irrelevant. Three types of irrelevance were identified: untopicality, undecidability, and taboo. Untopicality refers to focusing on specific topics (e.g., technical risk) while deeming other topics irrelevant. Undecidability concerns the inability to specify a risk as true or false due to a lack of consensus on the risk’s severity or conflicting objectives among project stakeholders. “Taboo” risks are those that may entail the disclosure of negative, discomforting information to project stakeholders and should therefore be avoided. Moreover, Kutsch and Hall (2009) conducted interviews with IT project managers, followed by a survey, and identified several factors that reduce the likelihood of implementing formal risk management. Firstly, the problem of cost justification refers to the difficulty in justifying the time and cost required for risk management. Secondly, the problem of anxiety arises when disclosure of potential risks causes anxiety among stakeholders and compromises the relationship with them. Thirdly, lack of expertise relates to project managers lacking necessary skills when managing risk; for instance, they might not be familiar with statistical tests. Fourthly, the problem of ownership occurs when risks are perceived to be managed by other parties or when there is no clear assignment of responsibility for managing risks. Finally, the problem of hindsight arises when project managers cannot predict future risks using historical data, which leads to hidden risks. A more recent study by Kutsch et al. (2013) investigated the risk management practises of twenty-one IS projects in ten organisations to determine why project managers disengage from the prescribed risk management process. The results revealed that the decision to disengage from risk management is influenced by five beliefs, which are:

1. *Legitimacy*: The belief about the pressure to adhere to the prescribed risk management routine.
2. *Value*: The belief that the benefits of risk management cannot be demonstrated.
3. *Fact*: The belief that risks are fictitious or imaginary because of risk information is unreliable.
4. *Competence*: The belief in one's inability to control risks.
5. *Authority*: The belief that one has limited power to act on risk mitigation.

To resolve the conflict between the relative performance of formal analysis and intuition in risk management, Moeini and Rivard (2019b) proposed a theoretical model of the factors influencing the relative performance of each approach. They defined these factors as follows: temporal complexity (how much risks fluctuate over time); structural complexity (the degree to which risks are intertwined in a project); stakeholders' involvement (the extent to which different stakeholders participate in risk management); methods-using pressures (the extent to which risk management is mandated); and expertise (how much experience a project manager has with managing similar IT projects). Based on the above discussion, Table 7 summarises the factors that cause project managers to not apply formal risk management practises or disengage from these practices. These factors were grouped into four categories: stakeholder-related factors, project managers' perceptions, competency and skills, and process effectiveness.

Table 7. Factors leading to disengagement from formal risk management practices

Category	Factors
Stakeholder-related factors	<ul style="list-style-type: none"> <li>• Disclosure of risk jeopardises the relationship with stakeholders</li> <li>• Disclosure of risk creates anxiety among stakeholders</li> <li>• Different risk management preferences exist among stakeholders</li> </ul>
Project managers' perceptions	<ul style="list-style-type: none"> <li>• Lack of trust in the accuracy of risk-related information</li> <li>• Risks are fictitious or imaginary</li> <li>• Inability to control risks</li> <li>• Limited authority or power to act on risk mitigation</li> </ul>
Competency and Skills	<ul style="list-style-type: none"> <li>• Lacking necessary skills when managing risk</li> <li>• Inability to scan and interpret the surrounding environment</li> <li>• Inability to predict future risks using historical data</li> <li>• Inability to specify a risk as true or false due to disagreement on its severity</li> </ul>
Process effectiveness	<ul style="list-style-type: none"> <li>• Difficulty in justifying the time and cost required for risk management</li> <li>• Benefits of risk management cannot be demonstrated</li> <li>• Lack of clear assignment of responsibility for managing risks</li> <li>• Focusing on specific topics while deeming other topics irrelevant</li> </ul>

While the above studies identified several factors influencing project managers' decision to disengage from risk management practises (e.g., risk perception, pressure for or against risk management, and authority to act on risk), other studies studied the effect of the identified factors

as well as other factors such as mental construals on engaging with certain activities (e.g., risk identification, risk impact assessment, and risk response enactment). For example, Shalev et al. (2014) studied the effect of mental construals (both abstract and concrete) on optimism bias in IT project risk management. According to construal-level theory, human behaviour is influenced by the perception of things as either psychologically near (concrete construal) or psychologically distant (abstract construal). Based on an experiment with 183 IT practitioners, they found that an abstract construal of a project risk leads practitioners (1) to have a more optimistic view of their ability to successfully manage project risk, (2) to prioritise benefits over costs when selecting a risk management plan, and (3) to identify more pros than cons regarding a risk management plan in comparison to a concrete construal. In a recent study, Lee et al. (2019) extended the work of Shalev et al. (2014) by examining the effect of IT project managers' mental construal on other risk management activities, including risk identification, risk impact assessment, risk response planning, and risk response enactment. They conducted four experiments in which 188 IT project managers participated. The experiments' findings showed that, compared to IT project managers with an abstract mental construal, those with a concrete mental construal (1) identify more risks, (2) perceive risks as having a greater potential impact, (3) believe risk management requires more effort and resources, and (4) are less likely to implement risk mitigation responses. Moeini and Rivard (2019a) developed a model that explains and predicts IT project managers' risk response decisions. The model proposes that a risk response decision is influenced by perceived risk exposure via an overall risk response attitude, perceived pressures for or against enacting the risk response, and perceived control over the risk response. Three distinct risk responses were used to instantiate the model, and each model instance was tested using a separate survey with a total sample size of 349 participants. The results indicated that overall risk response attitude has the greatest impact on risk response decisions, whereas the impact of perceived control varies across risk response instances. In addition, Taylor (2006) asserts that project managers do not follow risk-by-risk response planning as outlined in the formal risk management prescription but rather apply general mitigation strategies against all identified risks. The factors that influence engagement in risk management activities are summarised in Table 8.

Table 8. Factors affecting engagement in risk management activities

<b>Activity</b>	<b>Factor</b>	<b>Effect</b>
Risk planning	Mental construals (abstract and concrete)	Abstract construal of a project risk leads to focus on benefits over costs when selecting a risk management plan
Risk identification	Mental construals (abstract and concrete)	Project managers with a concrete construal identify more risks compared to those with an abstract mental construal

Risk impact assessment	Mental construals (abstract and concrete)	Project managers with a concrete construal perceive risks as having a greater potential impact compared to those with an abstract mental construal
Risk response planning	Mental construals (abstract and concrete)	Project managers with a concrete construal believe risk response implementation requires more effort and resources compared to those with an abstract mental construal
Risk response enactment	Mental construals (abstract and concrete)	Project managers with a concrete construal are less likely to implement risk mitigation responses compared to those with an abstract mental construal
	Perceived risk exposure	The influence of project managers' perceptions of risk on risk response decisions is indirect, as it is mediated by their overall attitude toward enacting that response.
	Risk response attitude	The expected side effects of a risk response may prevent project managers from enacting it despite a strong risk perception.
	Perceived pressures for or against enacting the risk	The effect size and predictive value of perceived pressures on risk response decisions are small.
	Perceived control over the risk response	The impact of perceived control varies across risk response instances

Since risk perception is a significant factor influencing project managers' risk-related decisions, several studies have attempted to determine what influences risk perception. For example, Mursu et al. (2003) compared a ranked list of risk factors in Nigeria with ranked lists of factors from different socioeconomic contexts, including the United States, Finland, and Hong Kong. They found several vital differences in the identified risk factors and their ranking. Another study examined the effect of three different factors on risk perception: the individual's expertise, the project's perceived control, and the use of an attention-shaping tool (Du et al., 2006). An experiment was conducted involving 102 IT project practitioners with high expertise and 105 university students with low expertise. The results revealed that (1) low perceived control increases risk perception, (2) attention-shaping tools are more useful for individuals with low expertise, and (3) individuals with high expertise perceive greater risks in IT projects. Keil et al. (2008) studied the influence of risk checklists on risk perception and decision-making. A role-playing experiment was conducted with 128 software practitioners. The results indicate that using a risk checklist influences practitioners' perceptions of salient risks in the given scenario. Specifically, practitioners who used a risk checklist were able to identify a greater number of seeded risks in the scenario, but they also identified a greater number of unseeded risks (i.e., risks not anticipated in the scenario). Jani (2011) used computer simulation to investigate how self-efficacy and risk factors (both endogenous and exogenous) influence project managers' perception of risk in the context of a failing IT project. The findings indicate that project managers tend to assess the risks associated with endogenous risk factors as being lower than those associated with exogenous risk factors due to their greater perception of control over endogenous risk factors. In addition, project managers with higher self-efficacy are more likely to

underestimate the risks of a troubled IT project than those with lower self-efficacy. Based on a survey of 102 IS project managers, users, and developers, Liu and Chiu (2016) investigated the impact of pre-project partnering on risk perception during IS development. Pre-project partnering is the management practice of key stakeholders forming a collaborative group to set goals and establish conflict resolution procedures before the project starts. Their findings indicate that project partnering has a positive effect on project managers' perceptions of risk, which impacts project performance.

A variety of stakeholders impact software projects, and their perspectives on project risks may differ. As Schmidt et al. (2001) noted, "it is quite possible that different stakeholders will have divergent opinions" on project risks (p. 29). Keil et al. (2002) reported that project managers and users perceive project risk differently. By employing the Delphi method, they found that users emphasise the significance of risks related to project management capabilities and skills, whereas project managers emphasise user-related risks such as user commitment and scope creep. Based on their findings, they concluded that it is important to understand the risk perceptions of other stakeholders. Addison (2003) conducted a Delphi survey to investigate the risks associated with developing e-commerce projects, including the perspectives of developers, project managers, clients and users, and academics. According to his findings, different stakeholders may rank the same set of risks differently, which is consistent with the findings of Keil et al. (2002). Liu et al. (2009) compared the risk perceptions of senior executives and project managers using the Delphi method. They found that project managers focus on lower-level risks related to requirements and user involvement, whereas senior executives focus on higher-level risks involving politics, organisation structure, process, and culture. Using a quasi-Delphi approach, Liu and Yuliani (2016) indicated that client managers and vendor managers have different perceptions of IT outsourcing risks. For instance, they revealed that certain risks (e.g., unclear requirements and lack of experience with project activities) were deemed critical by client managers but not by vendor managers (or vice versa). In addition, they pointed out that client and vendor managers' divergent perceptions of risk factors can result in disagreements regarding resource allocation or risk management approaches. Nuijten et al. (2018) investigated the differences between IT auditors' and IT managers' perceptions of risk. Through a quasi-experiment involving 76 employees of a financial institution, they found that IT auditors have greater risk perceptions than IT managers. In particular, when exposed to the same risks, IT auditors had a greater perception of risk than IT managers. Taken together, these studies suggest that there may be differences in how individuals perceive project risks depending on their roles.

Consequently, risk perception is influenced by factors such as culture, risk checklists, attention-shaping tools, self-efficacy, and expertise. Risk perception is also affected by one's project role; for example, project managers, users, and senior executives have different perceptions of risk

factors. Project's perceived control and pre-project partnering have also been suggested to influence risk perception. Table 9 provides a summary of the effects of the factors that influence risk perception.

Table 9. Factors affecting risk perception

<b>Factor</b>	<b>Effect</b>
Cultural differences	Different risk factors may be ranked differently by project managers from diverse socioeconomic backgrounds.
Risk checklists	Use of risk checklists can lead to identification of greater number of risks.
Self-efficacy	Project managers with higher self-efficacy are more likely to underestimate risks than those with lower self-efficacy.
Risk factors	Project managers tend to assess the risks associated with endogenous risk factors as being lower than those associated with exogenous risk factors due to their greater perception of control over endogenous risk factors.
Expertise	Individuals with high expertise perceive greater project risks than those with low expertise.
Attention-shaping tools	Attention-shaping tools are more useful for individuals with low expertise.
Project's perceived control	Low perceived project control increases risk perception.
Pre-project partnering	Pre-project partnering has a positive effect on project managers' perceptions of risk
Role	Different stakeholders (e.g., project managers vs. users, project managers vs. senior executives, or IT managers vs. IT auditors) may assess the same set of risks differently.

### 2.5.1 The research gap

The above discussion shows that risk perception is an important factor influencing project managers' risk-related decisions in the context of software projects. Regarding the decision to apply formal risk management practices, it is suggested that project managers disengage from these practises when they do not perceive risks because, for example, they lack confidence in the accuracy of risk estimations (Kutsch et al., 2013). Risk perception also influences the decision of whether or not to implement risk responses (Moeini & Rivard, 2019a). Keil et al. (2000) found a significant relationship between risk perception and the decision to continue or abandon a software development project. A similar study found that project managers who have a higher (or lower) risk perception are less (or more) committed to a failing IT project (Jani, 2011). Moreover, risk perception influences not only risk-related decisions and project escalation but also project performance (Liu & Chiu, 2016).

The extensive decision-making literature has emphasised the impact of risk perception on risky decision-making (Keil et al., 2000; Sitkin & Pablo, 1992; Sitkin & Weingart, 1995; Williams & Noyes, 2007). In addition, the role of risk perception should be considered in order to fully understand the decision-making process (Williams & Noyes, 2007). In this regard, Sitkin and

Pablo (1992) proposed a model of the key factors that influence risky decision-making, arguing that the effects of a number of factors (e.g., affect and self-efficacy) are not direct but rather mediated by risk perception. In fact, Keil et al. (2000) concluded that decision-making can be influenced by manipulating risk perception.

An important factor that affects decision-making through risk perception is problem framing (Sitkin & Pablo, 1992). This concept originates from prospect theory and describes that the way a problem is framed can affect the decision being made. However, problem framing has not been studied in the context of risk management-related decisions in software projects. This represents a significant gap in the experiential (behavioural) research on software project risk management. Therefore, this study uses the concept of problem framing to expand the theoretical understanding of IS project managers' risk management-related decisions. In particular, this study examines how project managers' initial project framing, which is based on their interpretation of project-related information, influences how they engage in risk management. The next section discusses the key concepts of prospect theory that inform this study.

## **2.6 Prospect Theory**

Behavioural studies suggest that project managers' risk perception is the most critical factor affecting their decision-making and behaviours in managing project risks. For example, risk perception can influence a project manager's decision to apply formal risk management practices or to implement risk responses. Problem framing, which originates from prospect theory, is a significant factor that influences decision-making through risk perception (Keil et al., 2000). Prospect theory, developed by Tversky and Kahneman (1981), predicts individual choices in risky decisions. By using prospect theory, this study puts the spotlight on project managers' project framing and provides new insight into how they engage in risk management activities. Framing and its related concepts, such as attribute framing, project framing, and reference points, will be discussed in the following subsections.

### **2.6.1 Framing effects**

The concept of framing states that people may become biased towards one option when making a decision due to the way the information is presented (Tversky & Kahneman, 1981). A well-known example of framing is the classic problem known as "Asian disease" (Tversky & Kahneman, 1981). In the Asian disease problem, subjects had to choose between two options proposed to combat a disease that is expected to kill 600 people. The first option has a chance to save some but not all people, while the second option has the possibility of saving everyone but also the possibility of saving no one. Thus, one group of subjects received a description of the outcome of the options in terms of lives saved, while another group received the same options, but their outcomes were described in terms of lives lost. As shown in Table 10, the number of

lives saved and lost and the related risk levels were identical, but the wording (framing) used to represent the options' outcomes was different. Such two different descriptions of the Asian disease problem, though logically equivalent, are referred to as "problem frames".

Table 10. The different descriptions of the Asian disease problem (Tversky & Kahneman, 1981)

<b>Lives-Saved Frame (Positive)</b>	<b>Lives-Lost Frame (Negative)</b>
<p><i>Option 1:</i> If program A is adopted, 200 people will be saved.</p> <p><i>Option 2:</i> If program B is adopted, there is a 1/3 probability that 600 people will be saved and a 2/3 probability that no people will be saved.</p>	<p><i>Option 1:</i> If program A is adopted, 400 people will die.</p> <p><i>Option 2:</i> If program B is adopted, there is a 1/3 probability that nobody will die and a 2/3 probability that 600 people will die.</p>

As a result, subjects preferred the sure option (Program A) in the lives-saved frame but preferred the risky option (Program B) in the lives-lost frame (Tversky & Kahneman, 1981). Subjects tended to be risk-averse when the information was presented positively but risk-seeking when the same information was presented negatively. When different semantic descriptions (or frames) of the same problem led to different decisions, this can be called the "framing effect".

Since the original experiment done by Tversky and Kahneman (1981), several studies on framing have been conducted, resulting in the emergence of various types of framing. According to Levin et al., (1998) there are three major types of framing: risky choice framing, goal framing and attribute framing. Table 11 summarises the distinctions between these three framing types in terms of what is framed, what the frame affects, and how the effect is measured.

Table 11. Types of framing effects (Levin et al., 1998)

<b>Frame type</b>	<b>What is framed</b>	<b>What is affected</b>	<b>How effect is measured</b>
Risky choice	Set of options with different risk levels	Risk preference	Comparison of choices for risky options
Attribute	Attributes or characteristics of an Object	Object evaluation	Comparison of attractiveness ratings for the object
Goal	Consequence or goal of a behaviour	Behaviour adoption	Comparison of the rate of adoption of the behaviour

Risky choice framing is considered the standard type of framing introduced by Tversky and Kahneman (1981). The "Asian disease" problem explained above is a typical example of this type of framing (Tversky & Kahneman, 1981). In this type of framing, a hypothetical decision scenario with choice options is presented. In the positive frame, the options' outcomes are represented as gains, whereas in the negative frame, they are represented as losses (Levin et al., 1998). The effect

is determined by comparing the choice proportions for the options across frames (Tversky & Kahneman, 1981). Fogelström et al. (2009) conducted multiple experiments to determine whether the results of Tversky and Kahneman’s experiments can be observed in the context of software requirement selection; that is, decision-makers are risk-averse when a gain is involved and risk-seeking when a loss is involved. In their experiments, participants were required to choose between requirements framed in terms of revenues (i.e., gains) or costs (i.e., losses). Table 12 shows an example of the question sets provided to the participants. The results revealed that the majority of participants selected the safe option in the revenue frame but the risky option in the cost frame. These results were consistent with the original prospect theory experiments.

Table 12. An example of question sets for revenue and cost (Fogelström et al., 2009)

<b>Revenue Frame (Gain)</b>	<b>Cost Frame (Loss)</b>
Select one requirement: A. Has a guaranteed revenue of \$10,000. B. Could raise \$2,400 revenue with 75% probability, and \$32,800 revenue with 25% probability.	Select one requirement: A. Has a cost of \$10,000. B. Could cost \$200 with 30% probability and \$14,200 with 70% probability.

Goal framing focuses on how a particular goal relates to promoting the adoption of a behaviour (Levin et al., 1998). The positive frame emphasises the positive consequences of engaging in the behaviour to achieve the goal, whereas the negative frame emphasises the negative consequences of not engaging in it (Krishnamurthy et al., 2001). Both frames can promote behaviour, but one is more effective at promoting specific types of tasks. The goal framing effect is measured by comparing the rate of adopting the behaviour across frames (Levin et al., 1998). Browne and Safi (2015), for instance, used goal framing to increase the persuasiveness of security messages communicated to users of information systems. Their findings revealed that positively framed messages resulted in a higher adoption rate for preventative security measures than negative messages; in addition, negatively framed messages resulted in a higher adoption rate for detective security measures than positive messages.

In attribute framing, a characteristic or attribute of an object is described in either positive or negative terms (Levin et al., 1998). Attribute framing can affect how people evaluate the object in question (Krishnamurthy et al., 2001). Evaluations can be expressed as ratings of favourability, yes/no judgements or accepting/rejecting the object (Levin et al., 1998). The attribute framing effect occurs because positive framing of an attribute evokes favourable associations in memory; conversely, the negative framing of the same attribute activates unfavourable associations (Levin & Gaeth, 1988). For example, the way in which a development task is described can influence the effort estimates produced by software developers; consequently, a development task described

as a “minor extension” may result in a lower effort estimation than the same task described as “new functionality” (Jorgensen & Grimstad, 2012). Mohanani et al. (2014) describe that the way system desiderata are framed or presented can affect design creativity. Their findings revealed that desiderata framed as “requirements” led to significantly fewer original designs than those framed as “ideas”. In the context of IS project escalation, Karevold and Teigen (2010) found that project managers were less likely to continue with a troubled project when the progress of the project was described in terms of the amount of work left instead of the amount of work done.

### **2.6.2 Subjective framing**

Research on framing has shown that people who were given different frames of a decision problem behave differently based on the frame. However, a common feature of previous framing studies is that they have primarily focused on how individuals react to positively or negatively framed information (Benschop et al., 2022). The objective was to present decision frames developed by researchers (e.g., percentage of survivors vs. percentage of deaths) to experimental subjects and to analyse the results using statistical techniques. This style of framing can be referred to as “imposed framing”. Imposed framing cannot adequately describe how people in real-life situations frame information for decision-making (Yu et al., 2015).

While most studies on framing have focused on how people react to imposed frames, this study, by contrast, investigates how people use framing and what can be learned from their framing usage; the focus is on the framing that is subjectively or spontaneously derived by people in a decision problem. This approach can be called “subjective framing”. Specifically, this study aims to understand how project managers interpret or frame project information (i.e., project framing), how they describe their framing, and how this influences their risk management engagement.

### **2.6.3 Project framing**

Project framing is another framing type that is particularly significant to this study. Project framing can be defined as the perception or attitude that a decision-maker has about a project (Benschop et al., 2011). Gaining insight into decision-maker’s project framing is useful since it can be indicative of his or her risk perception in the project (Benschop et al., 2011). Project framing can also encompass a compelling argument that justifies pursuing a particular course of action (Mähring & Keil, 2008). Mähring and Keil (2008) mention that how a project is viewed at the outset creates a framing that can influence subsequent actions and promote project escalation (i.e. tendency to persist with failing courses of action). A recent study revealed that the initial framing of IS projects presented in business cases may subconsciously bias the decision-makers toward investing in new IS projects (Benschop et al., 2022). The analysis of twenty IS business cases revealed that newly proposed systems are framed positively, whereas existing systems are framed negatively. This pattern of framing can lead to more positive views of newly proposed

systems and more pessimistic views of existing systems, which could result in the premature replacement of IS.

Therefore, this study suggests that the initial framing of IS projects developed by project managers influences how they engage in risk management. Project framing is the process by which project managers interpret project information and form a perception or view of the project. Project managers may develop and describe their project framing using any of the three primary types of framing: risky choice framing, goal framing, and attribute framing. In this regard, this study proposes that attribute framing will be primarily used by project managers to develop project framing for a variety of reasons. First, goal framing is used to promote the adoption of a behaviour or action. Second, risky choice framing is appropriate for hypothetical decision scenarios in which choice options are presented positively or negatively; it is often used to test how people react to different frames. Thirdly, attribute framing focuses on the characteristics or attributes of an object; therefore, attribute framing can influence how the object in question (i.e., a project) is evaluated or perceived. Some studies indicate that when people have a positive or negative view of an object (e.g., an IS project), they are more likely to describe the object's characteristics using positive or negative adjectives.

Sher and McKenzie (2006) suggest that there is "information leakage" from the frame selected by an individual, which contains information about the individual's intention and evaluation. For example, team leaders were more likely to describe a project team's progress in terms of their failure rate to communicate that the team was poorly performing, while they were more likely to describe the team's progress in terms of their success rate to indicate that the team was doing well (Sher & McKenzie, 2006). As such, an analysis of project managers' framing usage may leak information about their perspective on a project. Such leaked information can encompass the argument for their actions and behaviours in managing project risk.

#### **2.6.4 Reference points**

This study focuses on how people use framing and, thus, what determines which frame they choose. For instance, what determines whether a project manager describes the project's progress as "remaining work" or "completed work"? In this regard, McKenzie and Nelson (2003) suggests that the selection of a frame (e.g., 75% of work completed versus 25% of work remaining) to describe a current situation is influenced by the individual's reference point. For example, people tend to describe a 500-ml glass containing 250 ml of water as "half full" when it previously contained 0 ml (i.e., a low reference point) and as "half empty" when it previously contained 500 ml (i.e., a high reference point) (McKenzie & Nelson, 2003). Similarly, project managers would be more likely to describe the project progress in terms of remaining work when comparing actual progress to higher reference values (i.e., a completed task or one that is nearing completion) to

convey that the team is behind schedule (Karevold & Teigen, 2010). In contrast, they prefer to describe the project progress in terms of completed work when comparing it to lower reference values to indicate the team is performing well.

In this study, reference points are the comparative standards against which other objects are evaluated or measured (Tversky & Kahneman, 1981). In consumer behaviour area, consumers evaluate the purchase price of a product by comparing it to reference points such as the average prices of previous purchases or the current prices of previously chosen brands (Wang et al., 2021). In this way, project information lacks meaning by itself because, for example, it contains absolute values such as the project budget and duration; it needs to be compared to other information in order to be meaningfully interpreted. So, this paper proposes that project information is interpreted or framed by comparing it with various reference points. For example, the perceptions of attribute values such as project budget or duration are determined by reference points, rather than absolute values alone. Thus, when evaluating the allocated budget for a project, a project manager may compare this value with the budget of a similar previous project (i.e., the reference point). If the value of the budget attribute is greater than the reference point, it can be evaluated positively, whereas if it is lower, it can be evaluated negatively. Therefore, a project frame (i.e., the perception a project manager has about a project) could be formulated by comparing project information with different reference points.

### 2.6.5 The Role of prospect theory in this research

Prospect theory is used as a descriptive framework that guides this study in understanding the phenomenon of interest (i.e., risk management engagement). This prospect theory-based framework provides the concepts, including attribute framing, reference points, and project framing effects, which explain how the framing of a project develops and impacts risk management engagement (see Table 13). Project framing is essential to understanding how IS project managers engage in risk management because it indicates their perceived risk and encompasses the rationale of their actions or behaviours in managing risks. The attributes, reference points, and project framing effect are further explained and elaborated in the data collection and analysis. Thus, the prospect theory-based framework is used as an *a priori* framework that guides the data collection and analysis.

Table 13. Key concepts provided by the prospect theory-based framework

Concept	Definition	Source
Project framing	The perception or attitude a project manager has about a project, which is based on their interpretation of project-related information and can be either positive or negative.	Benschop et al. (2011); Mähring & Keil (2008); Tversky & Kahneman (1981)

Attribute framing	A characteristic or attribute of an object (i.e., a project) is evaluated (described) positively or negatively, which affects how the object is perceived.	Levin et al. (1998)
Reference points	The comparative standards against which other objects are evaluated or measured.	McKenzie & Nelson (2003); Tversky & Kahneman (1981)
Project framing effect	The effect of positive and negative project framing on risk management engagement.	Tversky & Kahneman (1981)

## 2.7 Chapter Summary

This chapter provided a theoretical background on software projects, the concept of risk, and risk management. Also, this chapter discussed the two main bodies of knowledge in software project risk management, which are normative knowledge and experiential knowledge. The focus of normative research has been on developing formal prescriptions for IS project managers on how to manage project risks. Such prescriptions include risk checklists, risk frameworks, process models, and risk response strategies. On the other hand, experiential studies suggest that project managers sometimes behave differently from normative prescriptions and disengage from the risk management process. However, little research has been done to explain IS project managers' judgements and behaviours in managing project risks. Therefore, this study seeks to advance experiential knowledge on software project risk management by examining how IS project managers engage in risk management activities and why they sometimes deviate from formal prescriptions. By using prospect theory, this study puts the spotlight on IS project managers' framing and provides new insight into how they engage in risk management activities. In particular, this study examines how IS project managers subjectively interpret or describe project information (i.e., project framing) and how this affects their engagement in risk management. The conceptual framework developed for this study aids in focusing and shaping the research process, informing the methodological design, and influencing the data collection and analysis techniques to be employed. The following chapter discusses the research paradigm and methodology used to address this study's research question and objectives.

## Chapter 3: Research Methodology

### 3.1 Chapter Overview

The objective of this study is to understand how IS project managers subjectively interpret project information (i.e., project framing) and how their project framing influences risk management engagement. In order to accomplish this objective, this chapter describes the research methodology and specific procedures used to conduct this study. The framework proposed by Creswell (2014, p. 35) was used to plan this study and structure this chapter. As shown in Figure 2, this framework includes four main components: philosophical assumptions (e.g., postpositivist, constructivist, or transformative), research approaches (e.g., qualitative, quantitative or mixed methods), types of inquiry within these approaches (e.g., experiment, ethnography, or case study), and methods of data collection and analysis.

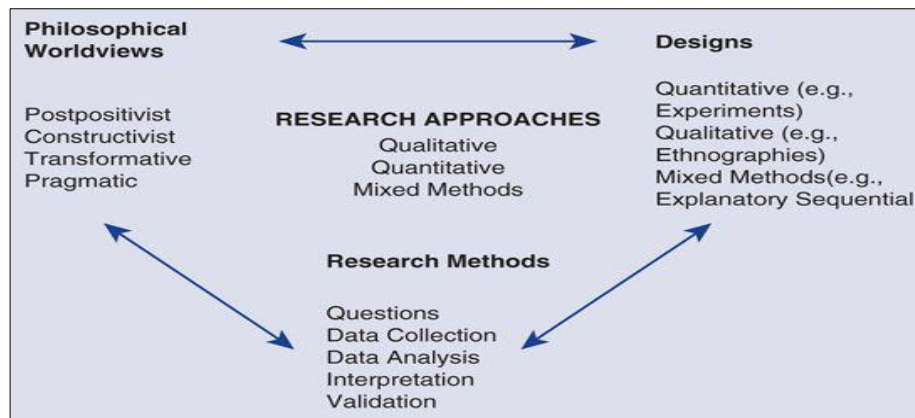


Figure 2. A framework for Research (Creswell, 2014, p. 35)

Therefore, this chapter is structured as follows: Section 3.2 outlines the philosophical assumptions underlying this study. Section 3.3 explains the selected research approach, including the rationale for this selection and the characteristics of this approach; Section 3.4 describes the research design, including sampling strategies and the role of theory. Section 3.5 describes the employed data collection method, including its benefits and the procedure followed to execute it. Section 3.6 describes the employed data analysis method as well as the steps taken to carry it out. Section 3.7 presents the criteria used to establish the trustworthiness of this study. Section 3.8 discusses the ethical considerations required for this study. The last section provides a brief concluding summary.

### 3.2 Research Paradigm

A research paradigm can be defined as “a basic set of beliefs that guide action” (Denzin & Lincoln, 1994, p. 107). These beliefs can also be termed philosophical assumptions and interpretive frameworks (Creswell, 2018), traditions and theoretical underpinnings (Bogdan & Biklen, 2007), epistemology and theoretical perspectives (Crotty, 1998), or theoretical traditions and orientations (Patton, 2015). In a research study, these beliefs are significant because they influence how the problem and research questions are formulated and how those questions are answered (Creswell, 2018); in other words, they influence how a research study is designed and conducted, as well as the interpretations of the results.

A research paradigm consists of two main concepts: ontology and epistemology (Denzin & Lincoln, 1994). Ontology refers to a researcher’s beliefs regarding the nature of reality and how it can be studied (Creswell, 2018). Epistemology, on the other hand, relates to the nature of knowledge and how it can be known (Denzin & Lincoln, 2018). There are four main research paradigms: positivism, postpositivism, constructivism, and critical theory (Creswell, 2018; Denzin & Lincoln, 2018; Merriam & Tisdell, 2015). Table 14 summarises these paradigms, with each paradigm viewed in terms of its research purpose as well as ontological and epistemological assumptions.

Table 14. Comparison between research paradigms (Source: Creswell, 2018; Denzin & Lincoln, 2018; Merriam & Tisdell, 2015)

<b>Paradigm</b>	<b>Purpose</b>	<b>Ontology</b>	<b>Epistemology</b>
Positivism	Explanation, prediction, control	Naive realism: reality exists and can be apprehended.	Dualist and objectivist: The investigator and investigated object are separate entities.
Postpositivism	Explanation, prediction, control	Critical realism: reality exists, but only imperfectly.	Modified dualist and objectivist: Dualism is abandoned, but objectivity remains.
Constructivism	Understanding, interpretation, reconstruction	Relativism: multiple interpretations of reality are possible.	Transactional and subjectivist: The investigator and investigated object are interactively linked.
Critical	Critique, transformation	Historical realism: reality is formed by social, cultural, political, and gender values.	Transactional and subjectivist: The investigator and investigated object are interactively linked.

The postpositivist paradigm was adopted in this study since its philosophical assumptions align with the characteristics of this study. Postpositivism adopts a “critical realism” ontology that assumes that reality exists, but only imperfectly (Denzin & Lincoln, 2018). This study believes that project managers’ subjective interpretation of project information (i.e., project framing) influences their engagement in risk management. However, it was challenging to know exactly

how they frame project information, including which project attributes they consider, how they evaluate those attributes, and how their project framing influences their risk management engagement.

On the other hand, postpositivism adopts a modified “dualist and objectivist” epistemology in which dualism is abandoned (i.e., the independence between the investigator and the investigated object) (Denzin & Lincoln, 2018). However, objectivity is emphasised by, for example, determining whether the findings fit with prior knowledge (Denzin & Lincoln, 1994). To understand how a project framing develops and impacts risk management engagement, this study believes that this understanding can be gained from IS project managers’ perspectives and experiences. However, objectivity is emphasised through the use of prospect theory as the main theoretical framework that guides this study. This framework provides the main concepts of interest, such as project framing, attribute framing, reference points, and framing effect. Postpositivism was, therefore, appropriate because it considers *a priori* theories and permits the use of qualitative techniques to understand how people interpret their experiences (Creswell, 2018; Denzin & Lincoln, 1994).

### 3.3 Research Approach

A research approach can be quantitative, qualitative, or mixed methods (Creswell, 2014). Quantitative research is an approach for testing objective theories by analysing the relationship between variables. These variables can be measured using instruments to generate numerical data, which can then be analysed using statistical techniques (Creswell, 2014). In contrast, qualitative research is an approach for understanding how people interpret their experiences, construct their worlds, and assign meaning to their experiences (Merriam & Tisdell, 2015). Mixed methods research combines quantitative and qualitative approaches to better understand a research problem than either approach alone (Creswell, 2014). Table 15 presents a comparison of the characteristics of these three approaches that is useful in choosing one (Creswell, 2014; Merriam & Tisdell, 2015).

Table 15. Characteristics of quantitative, qualitative and mixed methods approaches (Creswell, 2014; Merriam & Tisdell, 2015)

<b>Point of comparison</b>	<b>Quantitative</b>	<b>Qualitative</b>	<b>Mixed methods</b>
Focus	Quantity (how much, how many)	Quality (nature, essence)	Both quantity and quality
Philosophical assumptions	Positivism and postpositivism	Constructivism, critical, and postpositivism	Pragmatism
Strategies of inquiry	Surveys and experiments	Phenomenology, grounded theory,	Sequential, concurrent, and transformative

		ethnography, case study, and narrative analysis	
Design characteristics	Predetermined and structured approach	Flexible and evolving approach	Both predetermined and evolving approach
Data collection	Inanimate instruments, surveys, tests, scales	Researchers as primary instruments, interviews, observations, documents	Both quantitative and qualitative data collection

### 3.3.1 Definition and characteristics of qualitative research

Qualitative research is the study of “things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them” (Denzin & Lincoln, 2018, p. 43). Furthermore, the nature of qualitative research is defined by several characteristics. First, qualitative research focuses on capturing the views and perspectives of the participants. (Yin, 2015). Second, the primary instrument for data collection and analysis is the researchers (Merriam & Tisdell, 2015). Qualitative researchers collect the data themselves rather than relying on instruments or questionnaires developed by other researchers (Creswell, 2014). Third, the process of qualitative research is inductive, meaning that findings are inductively derived from the data in the form of themes, categories, hypotheses, or even theories (Merriam & Tisdell, 2015). Fourth, the outcome of a qualitative inquiry is richly descriptive, including what the researcher has learned about a phenomenon (Merriam & Tisdell, 2015). Quotes from interviews, field notes, or documents are always included to support the findings of the study. Fifth, the design of a qualitative study is flexible and emergent; this means that some or all phases of the research process may change after the researchers begin data collection in the field (Creswell, 2014). Sixth, the investigator in qualitative research often collects data in the natural setting or field; that is, the location where participants experience the problem being investigated (Creswell, 2014). Seventh, qualitative researchers typically collect, integrate and present data from multiple data sources, such as interviews, documents and observations (Yin, 2015). Finally, samples in qualitative research are small and usually selected purposefully, as opposed to samples in quantitative research, which are larger and more random (Merriam & Tisdell, 2015).

### 3.3.2 Rationale for qualitative research

This study aims to understand how project managers subjectively interpret or frame project information (i.e., project framing) and how this influences their engagement in risk management. A quantitative approach is often used to test how decision-makers react to framed information (e.g., Alewine et al., 2016; Karevold & Teigen, 2010; Mohanani et al., 2014). The focus is on presenting decision frames created by researchers to experiential subjects (i.e., imposed framing) and analysing the results using statistical procedures. Thus, a quantitative approach in which

imposed frames are manipulated may not provide a good description of how people, in real-life situations, frame decision-making information themselves (i.e., subjective framing). Therefore, a quantitative approach was not appropriate for this study. Accordingly, a mixed method approach was not suitable because it incorporates a quantitative feature.

Given that this study focuses on subjective framing and that little research to date has been conducted on this topic (Benschop et al., 2022), a qualitative approach was the preferred research approach for this study. The qualitative approach allowed for capturing project managers' perspectives and experiences regarding how they develop project framing and its effect on their engagement in risk management. A qualitative approach is appropriate when the aim is to understand the phenomenon of interest from the participants' perspectives (Merriam & Tisdell, 2015). Creswell also suggests that qualitative research is conducted when a complex, detailed understanding of the issue is needed (Creswell, 2018).

### 3.4 Research Design

Qualitative research is an umbrella term that includes a variety of qualitative research approaches. There are five common qualitative research approaches: narrative research, phenomenology, ethnography, ground theory, and case study (Creswell, 2018; Merriam & Tisdell, 2015). The overall purpose of these types of qualitative research is to understand how people interpret their experiences (Merriam & Tisdell, 2015). Each approach, however, has a different focus, resulting in differences in the study's steps, data collection and analysis, and report (Creswell, 2018). Table 16 presents several dimensions that can be used to differentiate between these qualitative research approaches (Creswell, 2018).

Table 16. A comparison of the common qualitative approaches adapted from Creswell (2014)

<b>Approach</b>	<b>Focus</b>	<b>Data collection</b>	<b>Data analysis</b>	<b>Research outcome</b>
Narrative research	Exploring the life of an individual	Using primarily interviews and documents	Stories are analysed thematically (what was said) or structurally (the nature of the telling of the story)	Constructing a narrative of an individual's life experiences
Phenomenology	Understanding the meaning of experiences around a phenomenon	Using primarily interviews, but also observations, documents, and art.	Data is analysed for significant statements, meaning units, and "essence" description	Describing how the phenomenon was experienced and discussing the meaning of themes.
Ethnography	Interpreting the behaviour of a culture-sharing group	Collecting data primarily through observations and interviews	Analysing data by describing a culture-sharing group and identifying its themes	Explaining how a culture-sharing group operates using a culture portrait

Ground theory	Developing a theory emerged from the data	Using mainly interviews with 20-60 individuals	Data is analysed through open coding, axial coding, and selective coding	Generating a theory presented as a diagram or as propositions
Case study	Using single or multiple cases to illustrate an issue	Using a variety of sources including interviews, observations, and documents	Analysing data by describing the case and its themes, as well as cross-case themes.	Developing an in-depth description and explanation of one or more cases.

For this study, all qualitative research approaches presented in Table 16 were considered. Narrative analysis focuses on collecting stories about individuals' lived experiences (Creswell, 2018). Narrative analysis was an inappropriate research design because the goal was not to collect participants' stories and analyse their structure, language, or cultural context. Phenomenology focuses on the "essence" of how individuals experience a phenomenon (Merriam & Tisdell, 2015). A phenomenology design was not suitable for this study because it requires the researcher to concentrate on a single concept or phenomenon and the essence of the participants' lived experiences in relation to that phenomenon. In ethnography, the goal is to describe the behaviour of a culture-sharing group (Creswell, 2018). This study did not focus on describing the culture of a group of project managers and identifying the group's shared patterns of language and behaviour, so ethnography was not an appropriate design. The goal of grounded theory is to build a theory about the phenomenon of interest (Creswell, 2018). Because the purpose of this study was not to generate a theory, but rather to use a theory to guide the design and execution of this study, ground theory was inappropriate.

Therefore, the case study was the most appropriate design for this study. According to Yin (2018), a case study is defined as "an empirical method that investigates a contemporary phenomenon (the "case") in depth and within its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident" (p. 45). Thus, a case study is more suitable compared to other methodologies when: (1) research questions are "how" or "why" questions; (2) the researcher has little or no control over behavioural events; and (3) the focus is on studying contemporary events in a real-life context (Benbasat et al., 1987; Yin, 2018).

This study conforms to the justification for conducting a case study in IS research. First, the form of this study's research question is a "how" question; specifically, how does project managers' project framing influence their engagement with risk management? Second, the researcher focuses on project managers' current approaches to framing project information and engaging in risk management and therefore has no influence or control at the time of data collection. Finally, this study investigates project managers' project framing and risk management engagement using examples of recent projects undertaken in software and telecommunication companies; thus, the phenomenon involves studying contemporary events in a real-life context.

### **3.4.1 Case study design**

An important component of a case study design is defining the “case” to be studied (Benbasat et al., 1987). A case is a single entity or unit with defined boundaries (Merriam & Tisdell, 2015). An individual, a group (e.g., a task force, profit centre, IS group), or an organisation are examples of more concrete cases, while a specific project or a decision are examples of less concrete cases (Benbasat et al., 1987). In this study, a single IS project manager is the case and unit of analysis. The case study concerns an individual IS project manager’s approach to developing project framing and its effect on risk management engagement. Thus, the goal of the study was to extract or surface IS project managers’ risk management models from them.

As little research to date has been conducted on the development of project framing and its effects in the IS project context, the objective of this study was to achieve an increased understanding of this phenomenon and the particular concepts that comprise such framing. The case study was, therefore, exploratory in nature (Sarker et al., 2018). Therefore, the key concepts of attribute framing, reference points, and project framing effects are further explained and elaborated in the data collection and analysis. Previous examples of exploratory case studies in IS investigated: 1) the process of strategic information systems implementation (Silva & Hirschheim, 2007); 2) the formal contractual and relational governance affecting artificial intelligence outsourcing (Beulen et al., 2022); 3) the social IT alignment process required for IT-enabled transformation (Pelletier et al., 2021); and 4) the alignment process of big data (Xu et al., 2023).

Case study design can include both single-case and multiple-case. The single-case design is useful for a critical case that tests a theory, an extreme case that deviates from theoretical norms, or a longitudinal case that studies the same case at different points in time (Yin, 2018). Therefore, the multiple-case design was chosen for two reasons: first, the results of a multiple-case study are thought to be more compelling, and the study as a whole is, therefore, stronger than a single-case study (Merriam & Tisdell, 2015; Yin, 2018); second, a multiple-case design allows for cross-case analysis and uses the replication logic, in which additional cases are expected to give similar results (a literal replication) or contrary results (a theoretical replication) (Creswell, 2018; Yin, 2018). Therefore, a multiple-case design allows for capturing different project managers’ perspectives on how a project framing develops and impacts risk management engagement. Further, it allows for integrating the findings from all cases and identifying the differences and common themes among them. This means that the study has greater validity and generalizability than a single case would permit (Glaser & Strauss, 1999).

### **3.4.2 Role of theory in the study**

Theory plays a critical role in qualitative research (Sarker et al., 2018), given that theory gives data “order, sense, and meaning” (Harrington, 2005, p. 5). Theories can be used as a source of

hypotheses to be empirically tested, as a lens to investigate a phenomenon, as scaffolding to develop a middle-range theory, or as a guide for data collection and analysis (Sarker et al., 2013). In this study, Prospect theory was used as a lens to examine the phenomenon under investigation and as a descriptive framework to guide data collection and analysis. This theory provided the key concepts that helped understand how IS project managers engage in risk management. These concepts include attribute framing, reference points, and framing effect. Therefore, they were used as a basis for developing the interview guide and categorising empirical findings.

### **3.4.3 Case selection**

Purposeful sampling was used to select this study's cases. Purposeful sampling enabled the researcher to use his judgement to select cases from which the most can be learned (Merriam & Tisdell, 2015). According to Patton (2015), the power of purposeful sampling is "selecting information-rich cases to study, cases that by their nature and substance will illuminate the inquiry question being investigated" (p. 542). Furthermore, this type of sampling is often used with small samples, such as in the case study methodology (Saunders et al., 2019). The criteria for selection of cases were: project managers who, first, have been working in the IT and telecommunications industry and second, had at least three years of work experience in managing software projects.

There are several strategies for purposeful samplings, such as maximum variation, extreme case, homogenous, typical case, and snowball (Patton, 2015). Also, one or more strategies can be used in a single study (Creswell, 2018). In this study, maximum variation and snowball sampling strategies were adopted. Maximum variation sampling was used to identify cases with diverse characteristics of interest for the study (Creswell, 2018). These characteristics included current position, years of experience, education, and certifications. The purpose was to identify important common themes that cut across different cases. Patton (2015) argues that "any common patterns that emerge from great variation are of particular interest and value in capturing the core experiences and central, shared dimensions of a setting or phenomenon" (p. 577).

Snowball sampling, on the other hand, allowed the researcher to identify new participants by asking participants to refer others who meet the criteria of interest in the study (Merriam & Tisdell, 2015). This was especially useful because it was difficult to establish contact with project managers in New Zealand's software industry. Snowball sampling is commonly used when reaching relatively closed, hard-to-access groups or communities (Rose et al., 2014).

When using multiple cases, it is essential to determine the number of cases deemed sufficient for the study (Yin, 2018). In this study, the number of cases was determined based on theoretical saturation (Saunders et al., 2019; Yin, 2018), which means that no new cases were added when the most recent cases offered few new insights, more practically, when it became apparent that

the changes in the coding template were becoming increasingly minor. In total, ten cases were examined for this study.

### **3.5 Data Collection**

According to Yin (2018) the methods of data collection that are commonly used in case study research include documents, archival records, interviews, direct observations, participant observations, and physical artefacts. For this study, interviews were selected for collecting the data. Interviews are described as “a construction site of knowledge” (Kvale, 1994, p. 2), where two (or more) individuals engage in a “conversation focused on questions related to a research study” (Demarrais, 2004, p. 55).

Interviews were chosen for this study because they offer the potential to capture participants’ experiences and perceptions of the topic under investigation (Morris, 2015). This aligns with the objective of this study, which seeks to understand project managers’ perceptions of how a project framing develops and impacts risk management engagement. Also, interviews have several benefits. First, interviews allow for getting rich data at less cost than other methods (Marshall, 2011), especially when conducting case studies of a few select individuals (Merriam & Tisdell, 2015). Second, interviews allow for probing for additional information and examination of complexity (Morris, 2015).

Interviews can take different forms, which are structured, semi-structured or unstructured (Merriam & Tisdell, 2015). In structured interviews, questions and their order are determined ahead of time. In contrast, unstructured interviews are more flexible and do not rely on a predetermined set of questions. Semi-structured interviews were selected for this study because they give the researcher more control over the interview’s topics than unstructured interviews (Given, 2022), but unlike structured interviews, they give participants “a great deal of leeway in how to reply” (Bryman & Bell, 2015, p. 481). Therefore, semi-structured interviews allow for the data collection to be guided by the concepts of interest, such as attribute framing, reference points, and framing effect, which were derived from prospect theory. These concepts were used as the basis for developing the interview guide. Further, semi-structured interviews allow the researcher to pose new questions or change the order of questions based on the participant’s responses (Morris, 2015).

The interview guide included a variety of questions concerning each of the concepts of interest, including project framing, reference points, and framing effects. The main topics included in the interview guide are project perception development, project perception description, and the effect of project perception on risk management. Moreover, the interview guide was modified several times during data collection. These modifications included rephrasing complex questions or

adding new topics and questions; for example, the topic “project perception change” was added to the guide. The final interview guide is provided in Appendix A.

Data was gathered over a 14-month period from July 2021 to September 2022. A total of 26 interviews were conducted, each interview approximately 1.5 hours in duration. Out of 26 interviews, seven were conducted face-to-face, and 19 were conducted online via Zoom or Google Meeting. All interviews were recorded and transcribed. The interview process in this study included five phases: the setting-up phase, the ice-breaking phase, the questioning phase, the probing phase, and the concluding phase. This process was based on the recommendations of Jovchelovitch and Bauer (2022) and Morris (2015). Table 17 provides a summary of the rules governing each phase of the interview process. These five steps are described in detail in the following sub-sections.

Table 17. The phases of the interview process

<b>Phases</b>	<b>Rules</b>
Setting-up phase	Sending an introductory email to participants Not imposing a time or day Venue needs to be comfortable and secure
Ice-breaking phase	Developing a rapport with participants Emphasizing the interview’s confidentiality
Questioning phase	Avoiding challenging or complex questions No interruptions Displaying active listening
Probing phase	Not many “why” questions Asking for further details
Concluding phase	Allowing participants to add Verifying the transcriptions’ accuracy

### **3.5.1 Setting up phase**

Setting up interviews is an important step for establishing rapport before the actual interview and ensuring its success (Morris, 2015). This included: a) sending an introductory email to each participant; b) setting up an appointment; and c) choosing the method of interviewing. The introductory email included a brief note on the purpose of the research and emphasises the confidentiality of the interview. A copy of the information sheet and consent form was also attached to this email (see Appendices B and C).

After confirming the email and willingness, a follow-up email or phone call was made to set up an appointment and choose the method of interviewing (i.e., face-to-face or online). Face-to-face interviews were conducted in a convenient place, such as AUT premises, coffee shops, or participants’ offices. For online interviews, Zoom and Google Meet were used because they allow

for recording the interview and can be integrated with other software like Otter to automatically transcript the interview.

### **3.5.2 Ice-breaking phase**

The interview started with a general conversation to break the ice and develop a rapport; this included introducing myself, explaining the purpose of the study, and conversing about general topics (e.g., the participant's job). Examples of ice-breaker questions are "What is your current position in the company?" and "How long have you been with this company?". This creates a relaxed atmosphere in which participants feel comfortable and are prepared to answer questions candidly and comprehensively (Brinkmann & Kvale, 2015). In addition, the participants were asked to sign the consent form.

### **3.5.3 Questioning phase**

The participants were then asked the questions contained in the interview guide. Challenging or complex questions were avoided at the beginning; this could result in awkwardness or distress and negatively affect the rest of the interview (Leech, 2002). In addition, interruptions were avoided unless required, as this could lead to missing important information or be interpreted as rude (Morris, 2015). However, the researcher displayed interest and active listening by using words such as "mm", "right" and "yes" or non-verbally by nodding and smiling. According to Flick (2018), active listening demonstrates empathy and understanding with the participants. Interview notes were used during the interview session to help the researcher organise the interview, conduct a preliminary analysis, and obtain participant feedback on the veracity of the findings and interpretations. An example of interview notes is provided in Appendix D.

### **3.5.4 Probing phase**

Probing included asking the participants to clarify, expand, or give examples of an answer. Examples of probing questions are "Could you please give me a more explanation on how you evaluate the scope attribute?", "Does the evaluation of these attributes change over the project lifecycle?" and "What is meant by casual or informal way? Also, asking excessive "why" questions was avoided, as they could upset and confuse the participants (Morris, 2015).

### **3.5.5 Concluding phase**

The interviews were concluded by asking questions such as "Would you like to add further information on this topic?" and "Is it okay to contact you if I have any further questions?" Further, the participants were asked to suggest other people who may be interested in participating in the study. After completion of the interviews, the audio recordings were transcribed digitally using the Otter software. Also, the accuracy of the transcriptions was verified by comparing them to the audio recordings.

### 3.6 Data Analysis

The method used in this study to analyse data is template analysis, a particular style of thematic analysis (King et al., 2018). The core element of this method is the development of a coding template that summarises themes identified by a researcher in a meaningful way (Brooks et al., 2015). In template analysis, it is common to identify some themes in advance of coding, which is called *a priori* themes (i.e., aspects of the research question are of particular interest) (Brooks & King, 2014). However, *a priori* themes can be redefined or removed as the template is modified through data analysis. Furthermore, new themes, which emerge from data, may be added to the template.

Template analysis was deemed the most appropriate method for data analysis because it enables the use of *a priori* themes to guide the analysis while allowing for inductive themes to emerge from the data (King et al., 2018). Therefore, template analysis allows for the data analysis to be guided by the theoretical framework presented in Chapter 2; it offers concepts of interest such as attribute framing, reference points, and framing effect. These concepts were used as *a priori* themes for categorising and analysing the data.

The MAXQDA was used to facilitate the analysis process. MAXQDA is a qualitative data analysis (QDA) software. It provides the following features and capabilities (Kuckartz & Rädiker, 2019):

- *Hierarchical code system*: Organising codes into hierarchical order with up to 10 levels, and the ability to export the entire code system with code definitions to a Word document.
- *Creative Coding*: Arranging and structuring codes and themes visually on a blank canvas, and then transforming the final structure into the MAXQDA code system.
- *Memos*: Attaching notes and comments to specific documents, codes, or data segments, or writing free-form memos.
- *Thematic summaries*: Writing summaries of text passages assigned to specific codes on a case-by-case basis.
- *Visual tools*: Creating visual maps to facilitate the analysis and presentation of cases, code relationships, summaries, and code hierarchies.

The steps of template analysis proposed by King et al. (2018) were adapted to suit the specific needs of this study. Table 18 outlines the steps that were followed to apply the template analysis in this study. These steps are described in depth in the following subsections.

Table 18. Steps followed in this study to implement the template analysis

1. Identify <i>a priori</i> themes in advance of coding.
2. Select a subset of the interview data and become familiar with the data.
3. Code the data by assigning text segments to the relevant <i>a priori</i> themes and adding any new themes that emerge from the data.
4. Produce the initial coding template by clustering the coded segments for the emerging and <i>a priori</i> themes into meaningful clusters and organising them hierarchically.
5. Repeat steps 2 and 3 and modify the template until the final version of the template is developed.
6. Apply post-coding analysis (e.g., by writing thematic summaries per case).

### 3.6.1 Identifying a priori themes

Before starting any coding, a set of *a priori* themes was developed based on prospect theory. These themes included project framing, attribute framing, reference points, and framing effect. Table 19 lists the *a priori* themes and their definitions. In the MAXQDA software, top-level codes were created for the *a priori* themes. Each code was assigned a colour and a definition; this definition is recorded in a code memo.

Table 19. List of a priori themes used

<b>A priori themes</b>	<b>Definition</b>
Project framing	The way in which project managers interpret or frame project information, as well as how they describe their project framing.
Attribute Framing	A characteristic or attribute of an object (e.g., project) is described in either positive or negative terms.
Reference points	The comparative criteria against which other objects are evaluated or measured.
Effect of project framing	The effect of project managers' project framing on their engagement in risk management, including the difference between the effects of negative and positive framing.

### 3.6.2 Preparing and familiarising with the data

After developing the *a priori* themes, a subset of data was selected, including interview transcripts and notes. To prepare the interview transcripts for coding, the following transcription rules recommended by Kuckartz and Rädiker (2019) were used: (1) Paragraphs for interviewer and interviewee were introduced by a unique abbreviation, such as "T:"; (2) a blank line was inserted between the paragraphs to increase readability; (3) brackets were used for short interjections, e.g., "(A: Next attribute please)"; and (4) unclear segments of speech were identified by "(unclear)". A short extract from an interview transcribed according to these rules is shown in Figure 3.

**A:** Okay, how do you evaluate this attribute?

**SO:** It is given by the company they will tell us at the start of the project or you have to ask them whether they have a high appetite for risk or not.

**A:** Who in the company give you this piece of information?

**SO:** It will depend on the governance framework. So, it will depend on the governance framework. Rarely, I don't think it should be the sponsor. It should be a steering committee level at the lowest but really it's often (unclear) committee board depending on the breadth and scope of your project. (**A:** Next attribute please). The length of the project inherently, a project that is longer will have a higher level of risk just because it creates a higher level of unknown in general. So, personally I would say that any project longer than six months is risky.

Figure 3. Example of a transcript

I then familiarised myself with the data through an intensive reading of the interview transcripts and listening to the audio recordings. At this point, the interview transcripts and notes were imported into the MAXQDA software, where a document group was created for each participant. In addition, the background information (e.g., position, year of experience, highest level of education, etc.) was entered into the MAXQDA software as document variables.

### 3.6.3 Coding of the data

Once I felt very familiar with the data, I started working through each interview transcript and coding all segments of text that were relevant to my research question. If a segment of the text relates to one of the *a priori* codes, it was assigned to the appropriate code; if it could not be fitted into any of the *a priori* codes, it was assigned to the code “Other”. Overlapping coding was undertaken if one segment of text could be assigned to more than one code. The interviewer’s question was only coded if the response was not understandable on its own. Any questions that arose during coding were recorded in the form of in-document memos, which were inserted directly next to the relevant text passages. A sample of coding of interview data is shown in Appendix E.

### 3.6.4 Producing the initial template

After completing the coding for the first three cases, the initial coding template was created. To create the initial template, the coded segments for each top-level theme were clustered into meaningful groups to create sub-themes. For example, under the top-level code “Attribute Framing”, two subcodes were created, “Positive attribute frames” and “Negative attribute frames”, to distinguish the framing type of attributes. Under the top-level code “Effect of project framing”, the subcodes “Effect of attribute frames” and “Effect of project frames” were created. Under the code “reference points”, the subcodes “internal reference points” and “external reference points” were created to specify the type of reference information.

### 3.6.5 Developing the final template

The initial template was used to code another subset of the data in an iterative process. Each iteration included two or three cases. Consequently, the initial template was modified after each iteration. This iterative process of template development was stopped when the changes in the template became small. Then, to finalise the template, it was applied to the entire data set, and additional coding refinements were made as needed. The final coding template is provided in Appendix F. The MAXQDA's Smart Coding and Creative Coding tools were helpful in this regard. The Smart Coding tool lists all the coded segments, one below the other, and enables the creation of new subcodes. The Creative Coding Tool is a visual tool that can be used to organise codes and form a hierarchical structure of codes. Examples of the types of modifications that were made to construct the final version of the template are as follows:

- *Inserting new codes:* New codes were created if text segments could not be fitted into any existing codes. For example, the new codes "Risk Disclosure", "Discipline Level", and "Risk Identification Topics" were added under the code "Risk Management Dimensions". Also, the codes "Customer Category", "Project Financial Importance", "Organisation Maturity", and "Project Complexity" were added as new attributes under the code "Attribute Framing".
- *Merging codes:* It was necessary to combine multiple codes that captured similar data into a single code. For example, the code "RM Go/No Go" and "Need to Engage in RM" were merged with the code "Adherence to Process".
- *Adding new top-level codes:* It was common practice to classify previously defined codes under new, more abstract categories. For example, the new top-level codes "Technical Intensity", "Perceived Intensity", and "Process-Related Activities" were used to group the codes related to risk management dimensions. Also, the attributes influencing project perception were categorised into "Objective Attributes" and "Subjective Attributes".
- *Moving codes:* In some cases, it was preferable to change the position of a code in order to construct a well-structured template. For example, the code "Risk Management Dimensions" was moved from its previous position as a subcode of "Project Framing Effect" to a top-level code.
- *Renaming codes:* If the name of a code did not accurately reflect its content, it was changed. For example, the code "Project team" was renamed "Team skills and experiences" because its content was about the project team's skills and experiences.

### 3.6.6 Applying post-coding analysis

Different forms of analysis were done after coding. For example, case-related thematic summaries were created using the Summary Grid and Summary Tables functions in the MAXQDA software.

Further, the relationships between some codes were analysed using the MAXQDA's Code Relations Browser tool. Furthermore, case comparisons were carried out using the MAXQDA's Compare Cases and Groups tool and an Excel spreadsheet. Figure 4 presents an example of a Code Relations Browser that shows the relationship between project framing effects and risk management dimensions.

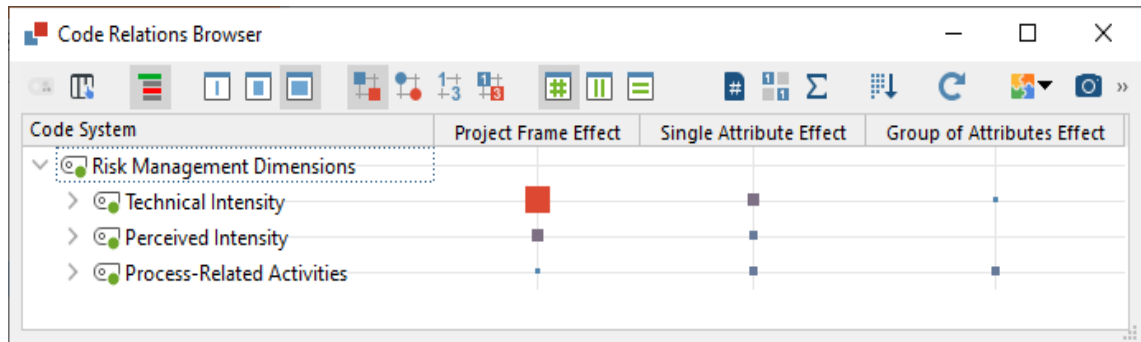


Figure 4. Example of a Code Relations Browser

### 3.7 Issues of Trustworthiness

Trustworthiness is concerned with how a researcher can persuade his or her readers (including self) that the study findings are worthy of attention (Lincoln & Guba, 1985). To establish the trustworthiness of this study, the criteria introduced by Guba and Lincoln (1985) were used. Lincoln and Guba (1985) use the criteria of credibility, dependability, transferability, and confirmability as the naturalist's equivalents for the traditional quantitative criteria of internal validity, reliability, external validity, and objectivity. Furthermore, they proposed various strategies for establishing each of these criteria. Table 20 shows the purpose of each criterion and the strategies employed in this study to attain them. In the following sub-sections, these trustworthiness criteria and corresponding strategies are discussed.

Table 20. Trustworthiness criterion and strategies employed in this study

Trustworthiness criteria	Purpose	Strategies to achieve criteria
Credibility	To establish confidence that the study findings are accurate and credible.	Triangulation Member checks Adequate engagement Peer debriefing
Dependability	To ensure that the study findings are consistent with the data collected.	Audit trail
Transferability	To enhance the possibility of applying the study's findings to other contexts or settings.	Thick description Maximum variation

Confirmability	To ensure that the study findings are determined by the data and not by the researcher's biases and subjectivity.	Audit trail Reflexivity
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### 3.7.1 Credibility

Credibility refers to whether a study's findings are accurate and credible from the perspective of the researcher, the participants, and the reader (Bloomberg & Volpe, 2012; Merriam & Tisdell, 2015). In order to establish credibility, four strategies were employed: triangulation, member checks, adequate engagement, and peer debriefing. Triangulation has four different modes: the use of multiple investigators, methods, sources of data, and theories (Denzin & Lincoln, 1994). In this study, triangulation using multiple sources of data was used, which involved comparing and cross-checking interview data collected from follow-up interviews with the participants (Merriam & Tisdell, 2015). The second strategy for ensuring credibility is member checks (Denzin & Lincoln, 2018). Member checks allow for obtaining participants' feedback on the veracity of the findings and interpretations (Creswell, 2018). This strategy entailed sending the interview transcripts or summaries of the researcher's conclusion to the participants so that they could assess their accuracy and credibility. The third strategy is adequate engagement (Merriam & Tisdell, 2015). For this credibility strategy, sufficient time was spent collecting data such that the data became "saturated"; that is, data collection stopped when no new information emerged (Yin, 2018). The fourth strategy is peer debriefing or peer examination (Denzin & Lincoln, 2018). In this strategy, the researcher sought an external review from a person who is familiar with the study's topic and methodology (Creswell, 2018). Peer debriefing was achieved through regular meetings with the researcher's supervisors and the presentation of a paper at a peer-reviewed conference and workshops, during which the study design, emerging findings, and tentative interpretations were discussed.

### 3.7.2 Transferability

Transferability concerns the extent to which a study's findings can be applied to other situations or contexts (Merriam & Tisdell, 2015). Transferability was addressed by the use of a thick description (Lincoln & Guba, 1985). This study provided a detailed description of the participants, as well as a detailed description of the findings with quotes from the interviews. These descriptions were included in the findings chapter. By providing a detailed description, the researcher enables the reader to determine whether and to what extent the findings can be transferred due to shared characteristics (Creswell, 2018). Another strategy used to enhance transferability is maximum variation (Merriam & Tisdell, 2015). Maximum variation was employed to have some variations in the characteristics of the participants (e.g., position, years

of experience, education); this increases the possibility of a greater range of application by readers or users of the study (Merriam & Tisdell, 2015).

### **3.7.3 Dependability**

Dependability refers to whether a study's findings are consistent with the data collected (Merriam & Tisdell, 2015). The audit trail was the main strategy used to establish dependability (Lincoln & Guba, 1985). An audit trail can be described as "comprising a log of all the processes followed, describing the small analytic leaps contributing to the analysis as a whole" (Silver & Lewins, 2014, p. 140). In this study, the audit trail was created by:

- Securely storing raw data, such as audio recordings of interviews, transcriptions, and field notes.
- Creating various memo types (e.g., code memos, document memos, and free memos) within the MAXQDA software to document the coding process and ideas for analysis.
- Maintaining multiple versions of the coding template containing the themes, definitions, and relationships.
- Creating various Excel worksheets to demonstrate how the findings were derived.

### **3.7.4 Confirmability**

Confirmability is concerned with establishing that a study's findings are derived from the data, rather than an outcome of the researcher's biases and subjectivity (Bloomberg & Volpe, 2012; Denzin & Lincoln, 1994). The primary technique for establishing confirmability is the audit trail (Lincoln & Guba, 1985). The audit trail was discussed under dependability criteria. Another strategy used is reflexivity (Merriam & Tisdell, 2015). Reflexivity means a researcher critically reflects on his or her assumptions, worldviews, and theoretical orientation to the relevant study (Merriam & Tisdell, 2015). For this strategy, I clarified my philosophical assumptions at the beginning of this chapter. I adopted a postpositivist stance, assuming that reality exists, but only imperfectly (Denzin & Lincoln, 2018). So, I believe that project managers' subjective interpretation of project information influences their engagement in risk management. Prospect theory was used as a descriptive framework that guided the data collection and analysis. It provided the main concepts, such as attribute framing, reference points, and framing effect, which were used to develop the interview guide and categorise the empirical findings. However, during the interviews, the participants were given the freedom to reply. By clarifying the researcher's assumptions and worldview, the reader can understand how these assumptions influenced the conduct of the study and shaped the interpretation (Merriam & Tisdell, 2015).

### **3.8 Ethical Consideration**

This study was conducted in accordance with the Auckland University of Technology (AUT) Code of Conduct for Research. Ethical approval was granted by the AUT Ethics Committee (AUTEK) prior to conducting the interviews on July 9, 2021. The ethics application approval letter is given in Appendix G. The ethical guidelines set by AUTEK were followed throughout the data collection to ensure the privacy and confidentiality of participants. First, participants were informed that their participation in this study was voluntary and that they might withdraw at any time. Second, pseudonyms were used to protect the identities of the participants. Third, the transcripts and audio recordings of interviews were securely stored as digital files in a folder on AUT's OneDrive. Hard copies of the consent forms and interview notes were stored in a locked cabinet on AUT premises. Fourth, personal information about the participants, such as their names and workplace affiliations, was not revealed in the research reports or papers.

### **3.9 Chapter Summary**

This chapter provided a detailed description of this study's research approach. This study adopted a postpositivist paradigm and thus believes that project managers' project framing influences their engagement with risk management. Since this study aimed to understand how project framing develops and impacts risk management engagement from the project managers' perspectives and experiences, qualitative research was chosen for this study. Accordingly, multiple case studies were conducted by gathering data from several project managers. Cases were purposefully selected based on predetermined criteria; in addition, maximum variation and snowball sampling strategies were adopted to identify cases with diverse characteristics (e.g., position and education) and obtain referrals to other potential participants. Prospect theory was used as a descriptive framework that guided the data collection and analysis. Interviews were the primary methods used for collecting the data. A total of 26 semi-structured interviews were conducted with project managers in various IT/IS companies in New Zealand. The data was analysed using the template analysis style of thematic analysis, and the MAXQDA software was used to facilitate the analysis process. To establish the trustworthiness criteria for this study (i.e., credibility, dependability, transferability, and confirmability), various strategies were employed, such as member checks, peer debriefing, audit trail, thick descriptions, and reflexivity. In the next chapter, the key findings obtained from 26 interviews are discussed based on the final coding template created during the data analysis.

## Chapter 4: Data Analysis and Findings

### 4.1 Chapter Overview

The purpose of this study is to explore how IS project managers subjectively interpret project-related information (i.e., project framing) and how this influences their engagement in risk management. This chapter presents the key findings obtained from 26 interviews that were analysed using the template analysis style of thematic analysis. First, background information and case summaries for each participant are briefly presented. Following this, the findings are presented based on the final coding template created during the data analysis, which includes five main themes: attribute framing, reference points, project framing, project framing effect, and project framing change.

### 4.2 Profile and Case Summaries of Participants

This section presents background information about each participant. This information came from the data collected during the interviews and the participants' LinkedIn profiles. To protect the identities of the participants, pseudonyms were used to identify them. This section also provides a case summary for each participant. This case summary includes four main themes: project framing, reference points, project framing effect, and risk management dimensions.

The following table presents the demographics of the ten participants who were interviewed in this study. Participants hold a variety of titles, such as senior project manager, programme manager, consulting practice lead, managing director, etc. The majority of the participants (7) are certified project managers and have post-graduate degrees. Five of the ten participants hold a master's degree, one holds a diploma, and one holds a doctorate. The majority of participants (8) have more than ten years of experience managing software projects, while only two have less than ten years of experience.

Table 21. Profile of participants

Case	Pseudonym of participant	Title	Experience in software projects (years)	Highest level of education	Certified project manager	Organisation
1	Thomas	Senior project manager	15	Master	Yes	Duco
2	Albert	PMO manager	20	Master	Yes	Expert360
3	Andrew	Programme manager	21	Master	Yes	Vodafone NZ
4	Fernando	Senior project manager	13	Master	Yes	Vodafone NZ
5	Maxwell	IT engineering manager	15	Diploma	No	Vodafone NZ

6	Ashly	Consulting practice lead	18	Master	Yes	Axenic
7	Singh	IT transformation manager	6	Bachelor	No	Eagle
8	Sara	Senior project manager	5	Bachelor	Yes	Fidelity
9	Isaac	Managing director	10	Bachelor	Yes	OSS Group
10	Bill	Microsoft regional director	20	PhD	No	Microsoft

Thomas is a senior project manager who has over 15 years of experience in leading the delivery of migration and digital transformation programs for organisations in the information technology (IT), telecommunications, retail, government, and financial sectors in the Middle East and North Africa (MENA) and Asia-Pacific (APAC) regions. He held numerous positions at companies such as Vodafone, Duco Consultancy, and Datacom. He holds a Bachelor's degree in Computer Science and a Master's degree in Business Administration. He holds a number of certifications in project management, including Project Management Professional (PMP), Certified SAFe 5 Program Consultant, Certified SAFe 5 Scrum Master, and Associate Certified Coach. Table 22 presents the case summary for Thomas.

Table 22. Case summary for Thomas

Project Framing	He relies on the following attributes to build a perception of a project (project framing): team skills and experiences, project time, project budget, project scope, project outcome materiality, relationship with customer, and project size.
Reference Points	He uses the following reference points to evaluate the attributes: <ul style="list-style-type: none"> <li>• Previous engagement with customers</li> <li>• Previous project team experience</li> <li>• Previous evaluations of attributes from similar projects (e.g., cost of previous similar projects)</li> <li>• Expected impact of project on end-users/customers</li> <li>• Cross-project attribute comparisons (e.g., team skills/experiences and development technology)</li> </ul>
Project Framing Effect	His engagement with risk management is influenced by his project frame, which is based on the combined evaluation of the attributes (i.e., light touch PM project or highly involved PM project). Engagement is also influenced by a single framed attribute, such as Materiality of Project Outcome.
Risk Management Dimensions	The following risk management dimensions are affected by his project framing: funding, adherence to process, risk management approach, and risk impact and probability.

Albert is a Project Management Office (PMO) manager with 20 years of experience running IT services projects for large companies like xpert360, GBM, IBM, SoftMEMS, and MEMSCAP. He is skilled in the delivery of end-to-end solutions, large-scale integration projects, bid management, partnership building, and subcontractor management. He holds a Bachelor of Science in Computer Engineering as well as a Master of Business Administration. He holds a

number of project management certifications, including PMP, Professional Scrum Master, High Performance Leadership Program, and PMO. Table 23 presents the case summary for Albert.

Table 23. Case summary for Albert

Project Framing	He relies on the following attributes to build a perception of a project (project framing): project objectives and drivers, project outcome materiality, project budget, project time, project complexity, project scope, and organisation maturity.
Reference Points	He uses the following reference points to evaluate the attributes: <ul style="list-style-type: none"> <li>• Attributes evaluations based on expert judgements</li> <li>• Previous evaluations of attributes from similar projects (e.g., Time of previous similar projects)</li> <li>• Similar projects frequency</li> <li>• Expected impact of project on end-users/customers</li> <li>• Project-generated system alternatives</li> <li>• Across-project attribute comparisons (e.g., project scope and project size)</li> </ul>
Project Framing Effect	His engagement with risk management is influenced by his project frame, which is based on the combined evaluation of the attributes (i.e., high-risk project, medium-risk project, or low-risk project). Engagement is also influenced by a single framed attribute, such as Materiality of Project Outcome and Organisation Maturity, and a set of key attributes negatively impacting project success factors of stakeholders.
Risk Management Dimensions	The following risk management dimensions are affected by his project framing: funding, time investment, human resources involvement, discipline level, details and documentation, and risk identification topics.

Andrew is currently a programme manager. He has 25 years of experience in designing, constructing, developing, and delivering new solutions for major ICT vendors, as well as mobile and fixed operators. He worked for multiple companies in Egypt, Qatar, and New Zealand, including Etisalat, Siemens, and Vodafone. He has a Bachelor's in Telecommunications Engineering and a Master's in Business Administration. Certifications in project management he holds include Scrum Master, Prince2 Foundation, Agile at Work: Planning with Agile User Stories, and Learning Program Management. Table 24 presents the case summary for Andrew.

Table 24. Case summary for Andrew

Project Framing	He relies on the following attributes to build a perception of a project (project framing): project outcome materiality, regulatory and contractual obligations, project budget, documentation quality of existing solution, team skills and experiences, and project time.
Reference Points	He uses the following reference points to evaluate the attributes: <ul style="list-style-type: none"> <li>• Attributes evaluations based on expert judgements</li> <li>• Previous project team experience</li> <li>• Expected impact of project on end-users/customers</li> <li>• Expected impact of project on revenues</li> <li>• Across-project attribute comparisons (e.g., allocated project budget and estimated project budget)</li> </ul>

Project Framing Effect	His engagement with risk management is influenced by his project frame, which is based on the combined evaluation of the attributes (i.e., high-risk severity project, medium-risk severity project, or low-risk severity project). Engagement is also influenced by a group of framed attributes, which include the highest priority attributes identified based on project owner proprieties.
Risk Management Dimensions	The following risk management dimensions are affected by his project framing: funding, risk disclosure, risk response strategies, and risk impact and probability.

Fernando is a senior project manager. He has been working in this field for 13 years and has completed 30 projects involving software and infrastructure. He worked for several companies in Qatar and New Zealand, including ITS, GBM, Vodafone, and Instillery. He has a Master's degree in Banking and Finance in addition to his Bachelor's degree in Information Technology. He is certified as an Agile Certified Practitioner and Project Management Professional (PMP). Table 25 presents the case summary for Fernando.

Table 25. Case summary for Fernando

Project Framing	He relies on the following attributes to build a perception of a project (project framing): project time, project budget, customer category, team skills and experiences, relationship with customer, and project size.
Reference Points	He uses the following reference points to evaluate the attributes: <ul style="list-style-type: none"> <li>• Previous engagement with customers</li> <li>• Project team's working history</li> <li>• Similar projects frequency</li> <li>• Number of business units/areas affected by project</li> <li>• Across-project attribute comparisons (e.g., project budget and estimated project effort)</li> </ul>
Project Framing Effect	Each framed attribute influences his engagement with a particular dimension of risk management. For instance, the Budget attribute affects the level of detail and documentation for risk management.
Risk Management Dimensions	The following risk management dimensions are affected by his project framing: details and documentation, adherence to process, and risk impact and probability.

Maxwell currently holds the position of IT engineering manager. Most of his experience is in enterprise architecture and business support system (BSS) transformation. He was employed by a variety of companies in both New Zealand and the Middle East, including Vodafone, Nokia, Spark, Etisalat, and Siemens. His education includes a Bachelor of Science degree in Communication and Electronics as well as a Diploma in Computer Systems Networking. Table 26 presents the case summary for Maxwell.

Table 26. Case summary for Maxwell

Project Framing	He relies on the following attributes to build a perception of a project (project framing): project scope, project domain, team skills and experiences, development technology, project size, and relationship with customer.
Reference Points	He uses the following reference points to evaluate the attributes: <ul style="list-style-type: none"> <li>• Previous engagement with customers</li> <li>• Previous project team experience</li> <li>• Similar projects frequency</li> <li>• Required skill set</li> </ul>
Project Framing Effect	The combined evaluation of the attributes provides him with a positive or negative view of the project. A positive (or negative) project view indicates a low (or high) project risk. This project view (frame), in turn, affects his engagement with risk management.
Risk Management Dimensions	The following risk management dimensions are affected by his project framing: funding, time investment, human resources involvement, details and documentation, and adherence to process.

Ashly currently holds the position of consulting practice lead. In his 18 years of experience, he has implemented ISO 27001, PCI-DSS, risk assessment, service organisation control, and information security awareness and training for clients in the financial, industrial, government, media, telecommunications, and energy sectors in New Zealand and the Arabian Gulf. Among the companies he has worked for are Axenic Ltd., Meridian Energy, Alcatel, and Securemisr. He holds a bachelor's degree in engineering and a master's in management information systems. In addition, he is ISO 27001 Lead Auditor certified. Table 27 presents the case summary for Ashly.

Table 27. Case summary for Ashly

Project Framing	He relies on the following attributes to build a perception of a project (project framing): project outcome materiality, complexity of business processes, regulatory and contractual obligations, stakeholders' appetite, project budget, and project time.
Reference Points	He uses the following reference points to evaluate the attributes: <ul style="list-style-type: none"> <li>• Expected impact of project on end-users/customers</li> <li>• Project-generated system alternatives</li> <li>• Regulatory fines</li> <li>• Across-project attribute comparisons (e.g., project time and project team size)</li> </ul>
Project Framing Effect	Each framed attribute influences his engagement with one or more dimensions of risk management; for instance, the Materiality of Project Outcome attribute affects the budget allocated and the level of detail and documentation for risk management. A group of framed attributes also influences engagement.
Risk Management Dimensions	The following risk management dimensions are affected by his project framing: funding, time investment, human resources involvement, risk reviews frequency, details and documentation, risk impact and probability, and risk response strategies.

Singh is an IT transformation manager with over 16 years of experience working in the IT industry, both in-house and for vendors. He worked for a variety of New Zealand companies, including Eagle Technology, Linfox, and Spark Digital, in roles such as IT infrastructure and operations manager and senior infrastructure manager. He has a Bachelor’s degree in Information Systems and Technology. Table 28 presents the case summary for Singh.

Table 28. Case summary for Singh

Project Framing	He relies on the following attributes to build a perception of a project (project framing): project size, development technology, project scope, and project outcome materiality.
Reference Points	He uses the following reference points to evaluate the attributes: <ul style="list-style-type: none"> <li>• Similar projects frequency</li> <li>• Expected impact of project on business units/areas</li> <li>• Expected impact of project on end-users/customers</li> <li>• Size of business units/areas affected by project</li> <li>• Resources availability in market</li> <li>• Number of deployment locations</li> <li>• Across-project attribute comparisons (e.g., project size and allocated project budget)</li> </ul>
Project Framing Effect	His engagement with risk management is influenced by his project frame, which is based on the combined evaluation of the attributes (i.e., straightforward project or complex project).
Risk Management Dimensions	The following risk management dimensions are affected by his project framing: funding, time investment, human resources involvement, tools and techniques usage, risk reviews frequency, adherence to process, and risk management approach.

Sara is a senior project manager who has been running software projects for 5 years. She has held positions at companies in the UK and NZ, including Confluence and Fidelity Life Assurance. She is PRINCE2 Foundation and Practitioner certified and has a Bachelor’s Degree in Literature. Table 29 presents the case summary for Sara.

Table 29. Case summary for Sara

Project Framing	He relies on the following attributes to build a perception of a project (project framing): stakeholders’ appetite, project time, team skills and experiences, project outcome materiality, project complexity, and project scope.
Reference Points	He uses the following reference points to evaluate the attributes: <ul style="list-style-type: none"> <li>• Similar projects frequency</li> <li>• Expected impact of project on business units/areas</li> <li>• Integration intensity with existing systems</li> <li>• Number of required skills</li> </ul>
Project Framing Effect	Her engagement with risk management is influenced by her project frame, which is based on the combined evaluation of the attributes (i.e., low-risk project, medium-risk project, or high-risk project). Engagement is also influenced by a single framed attribute, such as Stakeholders' Appetite.

Risk Management Dimensions	The following risk management dimensions are affected by his project framing: funding, time investment, risk reviews frequency, and details and documentation.
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Isaac has 10 years of expertise managing software projects and currently holds the managing director position. He worked for a variety of companies in the United Kingdom and New Zealand, including TelstraClear, Telecom New Zealand, OSS Group Ltd., Eclipse Computing, and Datamatic Networks, in roles such as project manager, middleware consultant, and product manager. He has a Bachelor's in Accounting. He is certified as a PRINCE2 Project Management Practitioner. Table 30 presents the case summary for Isaac.

Table 30. Case summary for Isaac

Project Framing	He relies on the following attributes to build a perception of a project (project framing): project objectives and drivers, project outcome materiality, and regulatory and contractual obligations.
Reference Points	He uses the following reference points to evaluate the attributes: <ul style="list-style-type: none"> <li>• Expected impact of project on end-users/customers</li> <li>• Expected impact of project on revenues</li> </ul>
Project Framing Effect	The combined evaluation of the attributes forms his view or frame of a project (i.e., light touch project, risk-centric project or high-risk project). This project frame is indication of how important the risk is for the project. Therefore, his engagement with risk management is influenced by the project frame.
Risk Management Dimensions	The following risk management dimensions are affected by his project framing: funding, time investment, and details and documentation.

Bill is a Microsoft regional director and a professor of computer science. In addition, he is a member of the ISO advisory committee responsible for publishing the official Arabic versions of worldwide IT standards. He has over 25 years of experience in the ICT industry and has completed over a hundred projects for national, regional, and international clients. He has received numerous international awards in the field of ICT, including Microsoft's Golden Global Impact Award and the Most Valuable Professional (MVP) award for 15 years in the software engineering and cloud fields. Table 31 presents the case summary for Bill.

Table 31. Case summary for Bill

Project Framing	He relies on the following attributes to build a perception of a project (project framing): customer category, project size, project financial importance, project time, project complexity, project outcome materiality, and project scope.
Reference Points	He uses the following reference points to evaluate the attributes: <ul style="list-style-type: none"> <li>• Similar projects frequency</li> <li>• Company's current financial situation</li> <li>• Expected impact of project on end-users/customers</li> </ul>

	<ul style="list-style-type: none"> <li>Resources availability in market</li> <li>Across-project attribute comparisons (e.g., project size and expected project revenue)</li> <li>Complexity of features list</li> <li>Expected simultaneous transactions volume</li> </ul>
Project Framing Effect	First, he calculates the total risk value for the project based on the evaluation of these attributes; second, this value is divided by the expected revenue from the project to calculate the loss percentage due to the project's risk; and finally, he determines the appropriate approach for managing risks based on this percentage (e.g., if the percentage is greater than 50%, a dedicated team is assigned to monitor and manage risks).
Risk Management Dimensions	The following risk management dimensions are affected by his project framing: funding, human resources involvement, tools and techniques usage, details and documentation, and risk management approach.

### 4.3 Attribute Framing

The first section of the findings describes the various attributes that participants consider when forming a perception or view of a software project. Table 32 lists the names of the attributes provided by participants and their paraphrased names.

Table 32. Names and paraphrases of the attributes

Paraphrased attributes names	Attributes' names given by participants	Participants
Project budget	Budget	Andrew, Albert, Ashly, Thomas
	Budget constraint	Fernando
Complexity of business processes	Business process supported	Ashly
Customer category	Customer category	Bill
	Nature of business	Fernando
Relationship with customer	Customer complexity and relationship	Thomas
	Previous relation with customer	Fernando
	Relationship with customer	Maxwell
Documentation quality of existing solution	Documentation of existing solutions or functionality	Andrew
Project outcome materiality	Impact of project outcome	Andrew
	Business outcome	Ashly
	Impact of project on business productivity	Singh
	Impact of project outcome on business	Albert
	Project impact	Sara
Project criticality	Criticality of project	Bill
	Project criticality	Thomas
Organisation maturity	Client maturity	Albert
Project complexity	Complexity of project	Sara
	Complexity of solution delivery	Albert
	Technical complexity	Bill
Project financial importance	Expected revenue from the project	Bill
Project objectives and drivers	Business benefits or objectives	Albert
Project size	Project size	Maxwell, Singh, Thomas

	Scale and size of project	Bill
	Size of project	Fernando
Regulatory and contractual obligations	Legal, regulatory and contractual obligations	Ashly
	Regulatory compliance	Andrew
	Rules and government regulations	Isaac
Project scope	Scope	Albert, Bill, Maxwell, Singh, Sara, Thomas
Stakeholders' appetite	Company's risk appetite	Sara
	Stakeholders	Ashly
Team skills and experiences	Project team experience	Fernando
	Resources skill set	Andrew
	Team capabilities and skills	Thomas
	Team experience and size	Sara
	Team skills	Maxwell
Development technology	Technology	Maxwell, Singh
Project time	Go-live date	Andrew
	Length of the project	Sara
	Schedule	Albert
	Time	Ashly, Bill
	Time restriction	Fernando
	Timeline	Thomas
Project domain	Project area	Maxwell

These attributes were divided into two major categories: objective attributes and subjective attributes. Objective attributes are directly associated with objective facts about a software project, such as the project budget, project time, project scope, regulatory and contractual obligations, and development technology. Subjective attributes, on the other hand, are based on the personal judgement of IS project managers and include project criticality, project complexity, project outcome materiality, and project financial importance.

In attribute framing, a characteristic or attribute of an object (e.g., a project) is described in either positive or negative terms (e.g., using positive or negative adjectives). Thus, statements describing any of the identified attributes were classified as either positive or negative attribute frames. Examples of positive and negative attribute frames are shown in Table 33.

Table 33. Examples of positive and negative attribute frames

Attribute frame	Frame type	Attribute
Very tight budget (Fernando)	Negative	Project budget
Budget, I would say was not suitable (Albert)	Negative	
Budget allocated is really suitable (Albert)	Positive	
Enough budget (Ashly)	Positive	
Business processes supported are not well defined (Ashly)	Negative	Complexity of business processes
Unknown or undocumented business processes (Ashly)	Negative	

With automating loosely defined or unknown business processes (Ashly)	Negative	
Business processes supported that are related to diagnosing patients are very well-defined processes (Ashly)	Positive	
Well-defined business process (Ashly)	Positive	
It is a low-maturity project management organisation (Albert)	Negative	Organisation maturity
Dealing with a high mature client or vendor (Albert)	Positive	
It [project] was more complex because there were more integrations to be done (Sara)	Negative	Project complexity
Complexity of the solution as I said, this has been done before and even i've i've worked on a project like that. So kind of Yeah, for me, it was a low (Albert)	Positive	
I have bad [customer] relation (Fernando)	Negative	Relationship with customer
They [cutomer] were a bit unknowledgeable (Maxwell)	Negative	
Customer with a good relation (Fernando)	Positive	
Customer is mainly the NTRA which is known customer and knowledgeable customer (Maxwell)	Positive	
Customer is somebody who i've dealt with before, and I know and have a good relation (Maxwell)	Positive	
We had a very good relationship with the customer (Thomas)	Positive	
Documentation of existing functionality and solution was very poor (Albert)	Negative	Documentation quality of existing solution
Project is really classified as mission-critical (Albert)	Negative	Project outcome materiality
This is a mission-critical system because it will affect all the crew who will be flying or their aeroplane (Albert)	Negative	
We are delivering a project for an airport, this is a mission-critical for the country (Albert)	Negative	
It is a business-critical system at the heart of the business (Isaac)	Negative	
That is a critical system in terms of the business outcomes (Ashly)	Negative	
Project actually was not mission critical or business important (Albert)	Positive	
It [project] is business as usual (Andrew)	Positive	
Project which could be classified as business as usual or normal operational system (Albert)	Positive	
Impact on the productivity of the business is minimal (Singh)	Positive	
This is extremely critical projects (Bill)	Negative	Project criticality
Critically of project is high (Thomas)	Negative	
Project is very critical to the company (Thomas)	Negative	
That's a critical project for, you know, hospital system that might threaten people life (Thomas)	Negative	
Complicated legal, regulatory, and contractual obligations (Ashly)	Negative	Regulatory and contractual obligations
Massive legal, regulatory and contractual obligations (Ashly)	Negative	
Regulations were not so complicated (Ashly)	Positive	
Scope was not really detailed enough (Maxwell)	Negative	Project scope
High level, vague or undetailed scope (Thomas)	Negative	
Scope, it is vague (Thomas)	Negative	

Scope is really well defined and detailed enough (Albert)	Positive	
Scope was very well written (Albert)	Positive	
Scope is clear (Maxwell)	Positive	
Very constrained scope (Sara)	Positive	
Scope was very well documented (Thomas)	Positive	
Scope is very straightforward (Singh)	Positive	
Size of the project is huge (Singh)	Negative	Project size
Project size is huge (Thomas)	Negative	
Project size, it was a big project (Maxwell)	Negative	
Size of the project is small (Singh)	Positive	
Project size is okay (Fernando)	Positive	
Team skills that was also actually not fit (Maxwell)	Negative	Team skills and experiences
Team skills were fit (Maxwell)	Positive	
Project team has the right skills for the technology to build this project (Thomas)	Positive	
Team has the right capability (Thomas)	Positive	
Experienced project project team (Fernando)	Positive	
We were migrating to a new technology, it was not really well known (Maxwell)	Negative	Development technology
I'm dealing with a bit of an unknown technology (Singh)	Negative	
New technology that has never been used before (Singh)	Negative	
It is known technology for us (Maxwell)	Positive	
Old technology (Singh)	Positive	
Schedule was very tigh (Albert)	Negative	Project time
Timeline was very aggressive and was not really realistic (Albert)	Negative	
Aggressive timeline (Thomas)	Negative	
Go live date was another challenging thing, because our evaluation highlighted that it is impossible to meet (Albert)	Negative	
Schedule was a good schedule (Albert)	Positive	
Timelines was relaxed (Thomas)	Positive	
It [go-live date] was easy to meet (Andrew)	Positive	
It [schedule] wasn't tight (Albert)	Positive	

Table 34 provides examples of positive and negative adjectives used in attribute framing. It is interesting that some positive adjectives, when combined with a specific attribute, form a negative attribute frame, and vice versa; for instance, when the positive adjective “new” is used with the development technology attribute, this attribute’s description or frame is negative. Participants sometimes use a positive adjective with denial to describe an attribute negatively, and vice versa.

Table 34. Examples of positive and negative adjectives used in attribute framing

Attribute	Positive adjectives	Negative adjectives
Project budget	Suitable, Sufficient, Enough	Tight, Wrong
Complexity of business processes	Well-defined, Documented Defined, Easy	Unknown, Undocumented, Complicated
Organisation maturity	High, Mature	Low

Project complexity	Low	Complex
Relationship with customer	Good, Known, Knowledgeable, Friendly, Okay	Less, Bad, Unknowledgeable, Challenging
Documentation quality of existing solution	Good	Poor
Project outcome materiality	Business-as-usual, Normal, Standard, Minimal	Mission-critical, Critical, Business-critical, High, Business-important, Crucial, Significant, Dependent
Regulatory and contractual obligations	Standard, Low	Complicated, Massive
Project scope	Detailed, Enough, Well-written, Achievable, Clear, Well-defined, Constrained, Documented, Measurable, Reasonable, Specific, Straightforward	Undetailed, High-level, Vague, Unclear
Project size	Small, Okay	Huge, Big, Large
Team skills and experiences	Fit, Fresh, Right, knowledgeable, Experienced	
Development technology	New, Known	Old, Scarce, Unknown
Project time	Realistic, Good, Relaxed, Easy, Enough	Tight, Aggressive, Challenging, Impossible, Difficult

#### 4.4 Reference Points

This section of the findings presents how participants evaluate the attributes that influence their perception of a project. All participants mentioned different standards or comparison criteria (i.e., reference points) they use to evaluate the attributes. For instance, in assessing the project time, it may be compared to the time of previous similar projects (i.e., the reference point). Table 35 illustrates how the reference points were derived from the responses of the participants.

Table 35. Examples of how reference points elicited

Participant Quote	Attribute	Reference points elicited
<i>Is it an aggressive timeline or pretty much relaxed? This is identified from the when I compare the project timelines to the average time to market or average timelines for similar projects. (Thomas)</i>	Project time	- Average timeline of previous similar projects
<i>Skill set when we say it's matching the purpose or fitting for purpose or not we are mainly speaking about if the team skills are matching the technology used in delivering the project or not. (Andrew)</i>	Team skills & experiences	- Technology used to build project
<i>So you measure this by simply saying the impact of the project on the productivity is it the low impact is it the high impact. Basically the number of end users impacted or the functions or the business unit impacted. (Singh)</i>	Project outcome materiality	- Number of end-users impacted by project - Number of business units impacted by project
<i>Complexity of the project is slightly different in my view. So this is mostly around the number of different skills that is needed to develop the project. So same thing requires a lot of coordination and probably will require specific people to be a variable at specific time. And this is also the</i>	Project Complexity	- Number of required skills - Integration intensity with existing systems

<i>idea of integration with whatever is existing already. (Sara)</i>		
<i>When we speak about the size we evaluate the size of the project, according to two numbers, the revenue, the expected revenue from the project and the time needed to build this project, the time that we think is fair enough to build this projects away of the customer request the time that is defined by the customer. (Bill)</i>	Project size	- Expected project revenue - Estimated project time

According to the source of reference, reference points were classified as either internal or external. Internal reference points are retrieved from memory and formed based on project managers' past experience. External reference points are obtained from the information acquired during the development of the project's perception (framing). On the other hand, reference points were classified based on the type of reference into historical references, project attribute references, organisational and environmental references, technical references, and expert judgement references.

Historical references include past similar projects (including previous evaluations of attributes and projects frequency), previous project team experience, and previous experience with customers. Some examples of participants' responses are given below:

*Do we have a tight budget or we have an allowance for contingency? And again, this is by comparing the project budget to the average actual cost of similar delivered projects. (Thomas)*

*Complexity of the solution as I said, this has been done before and even I've worked on a project like that. So kind of Yeah, for me, it was a low. (Albert)*

*If my scope is very straightforward, something that we've delivered a number of times to similar types of clients. (Singh)*

*This [relationship with customer] can be measured somehow by how many management escalations received from the customer in previous engagements, how easy and fast the invoicing between the parties. (Fernando)*

Project attribute references refer to any project-specific attribute, such as budget, schedule, or revenue, which can be used to evaluate other attributes; for instance, the project budget, revenue, and team size can be used to evaluate the project size. Some examples of participants' responses are given below:

*The time restriction we have to compare it with the effort required to deliver the project this is how you evaluate this time. (Fernando)*

*So is it a big project? Is it a small project and that that can be based on a number of things. So based on the cost of the project associated with it, that's a good indication how much investment is going into this project. (Singh)*

*We evaluate the size of the project according to two numbers, the expected revenue from the project and the time needed to build this project. (Bill)*

Organisational and environmental references are a set of indicators for a project's context and potential impact, which include the expected impact of the project (on end-users/customers, revenues, or business units/areas), resources availability in the market, the organisation's current financial situation, project-generated system alternatives, and regulatory fines. Some examples of participants' responses are given below:

*The importance of the project increases depending on the financial situation of the company. (Bill)*

*What is the impacted number of customers impacted by the outcome of this project? And also, what customer segment is impacted? So maybe it's a business segment or consumer individuals or big companies. (Andrew)*

*Also, if the system does not have any alternatives, like for example, in banks if the bank completely relies on automation and there is no manual work, this would also be a huge impact. (Albert)*

*It could be a scarce technology where even that technology exists for years and years, but there's only a handful of people know how to use this technology. (Singh)*

Technical reference points are a set of criteria related to software development, such as expected simultaneous transactions volume, deployment scale, number of integrations with existing systems, and required skill set. Some examples of participants' responses are given below:

*Actually, when we talk about the scale, it's related to two numbers. The first one is the expected amount of simultaneous transactions. So as much as the simultaneous transactions are huge, the scale is huge. (Bill)*

*Complexity of the project is slightly different in my view. So this is mostly around the number of different skills that are needed to develop the project. (Sara)*

Expert judgement references refer to the standards suggested by others, such as evaluating the complexity attribute of a project based on a solution architect. Some examples of participants' responses are given below:

*For that I use my previous experience if I have similar experience running or delivering a project like that, if not, I refer to the expert judgement to help me in understanding if this budget really would be a concern or not. (Albert)*

*We can have poor documentation or good documentation, and based on being poor or good, this will impact our project severity. And this comes after technical evaluation of the technical team who are going to deliver the project. (Andrew)*

Table 36 displays the various reference points used to evaluate each attribute, as well as their source and type.

Table 36. Reference points used in attributes evaluation

<b>Attribute</b>	<b>Reference points</b>	<b>Reference type</b>	<b>Reference source</b>
Development technology	Previous project team experience	Historical	External
	Similar projects frequency	Historical	Internal
	Resources availability in market	Organisational/Environmental	External
Documentation quality of existing solution	Project team evaluation of existing system documentation	Expert judgement	External
Project budget	Evaluation of budget based on experts	Expert judgement	External
	Cost of previous similar projects	Historical	Internal
	Estimated project effort	Project Attribute	External
	Estimated project budget	Project Attribute	External
Project complexity	Evaluation of complexity based on experts	Expert judgement	External
	Similar projects frequency	Historical	Internal
	Resources availability in market	Organisational/Environmental	External
	Development technology	Project Attribute	External
	Complexity of features list	Technical	External
	Integration intensity with existing systems	Technical	External
	Number of required skills	Technical	External
Project criticality	Expected impact of project on end-users/customers	Organisational/Environmental	External
Project domain	Similar projects frequency	Historical	Internal
Project financial importance	Company's current financial situation	Organisational/Environmental	External
Project outcome materiality	Expected impact of project on business units/areas	Organisational/Environmental	External
	Expected impact of project on end-users/customers	Organisational/Environmental	External
	Expected impact of project on revenues	Organisational/Environmental	External
	Project-generated system alternatives	Organisational/Environmental	External
Project scope	Scope of previous similar projects	Historical	Internal
	Similar projects frequency	Historical	External
	Estimated or allocated budget	Project Attribute	External
	Estimated or allocated time	Project Attribute	External

	Project size	Project Attribute	External
Project size	Size of previous similar projects	Historical	External
	Size/number of business units/areas affected by project	Organisational/Environmental	External
	Number of end-users/customers affected by project	Organisational/Environmental	External
	Estimated or allocated budget	Project Attribute	External
	Estimated or allocated time	Project Attribute	External
	Expected project revenue	Project Attribute	External
	Project team size	Project Attribute	External
	Expected simultaneous transactions volume	Technical	External
Project time	Number of deployment locations	Technical	External
	Evaluation of time based on experts	Expert judgement	External
	Time of previous similar projects	Historical	Internal
	Estimated project effort	Project Attribute	External
Regulatory & contractual obligations	Estimated project time	Project Attribute	External
	Regulatory fines	Organisational/Environmental	External
Relationship with customer	Previous engagement with customer	Historical	Both
Team skills & experiences	Previous project team experience	Historical	External
	Project team's working history	Historical	External
	Similar projects frequency	Historical	External
	Development technology	Project Attribute	External
	Required skill set	Technical	External

#### 4.5 Project Framing

This section of findings presents how a project framing is developed and described. On the one hand, participants form their perception of a project (i.e., project framing) by evaluating a set of objective and subjective attributes of the project, and this evaluation is determined by reference points. Thus, the evaluated attributes form the project framing. Furthermore, many participants indicated that the aggregated evaluation of the attributes provides them with an overall perception of the project (i.e., the project frame). For example, a project frame can be an indication of the project's overall risk, such as a low-risk project, medium-risk project, or high-risk project. Participants expressed this point in the following ways:

*So these attributes will identify whether or not this project is a light touch project management engagement required or it's a highly involved project management engagement. (Thomas)*

*So, it's based on the compound evaluation of the different attributes, I would get a perception of, I'm about to run or about to deliver a project of a high or medium or low risk. (Albert)*

*The overall project perception here for me, it's a pretty straightforward project. We've done it before many times we're applying it to a single site or location. The impact on the*

*productivity is standard. So that already gives me a perception that it's a pretty straightforward project. (Singh)*

*At the end of the day, we actually we build with these inputs and evaluating them, the perception of the project which in our case, that was something or you know around a medium risk for us and mainly this is affected by the undetailed scope, as well as the project size. (Maxwell)*

*So all of the attributes together should give you an idea of the level of unknown. So the most the more unknown and the more risky the project is. (Sara)*

On the other hand, when participants were asked to share their views of recent projects, they communicated their views by describing the attributes in negative or positive terms (i.e., attribute framing). An example of a project with a negative view in the MAXQDA software is provided in Appendix H.

#### **4.6 Effect of Project Framing on Risk Management**

This section presents the findings regarding how IS project managers' framing of project information affects their engagement in risk management. It is revealed that engagement in risk management has multiple dimensions. These dimensions were grouped into three categories: (1) technical intensity, which included funding, time investment, human resources involvement, tools and techniques usage, and risk reviews frequency; (2) perceived intensity, which included discipline level, details and documentation, adherence to process, and risk management approach; and (3) process-related activities, which included risk impact and probability, risk identification topics, risk disclosure, and risk response strategies. In Tables 37, 38, and 39, definitions and examples of participants' responses are provided for each of these dimensions of risk management engagement.

Table 37 Definitions and examples of participants' responses for the technical intensity dimensions

<b>Risk management dimension</b>	<b>Definition</b>	<b>Participant quote</b>
Funding	The proportion of the project budget that is allocated to risk management	<i>I would assume that I would need could be up to 10% of the project budget to be kept aside for the risk management practice. (Albert)</i>
Time investment	The proportion of the project duration that is allocated to risk management	<i>So as I mentioned beginning this is actually in the budget it's 5% to 10% and normally I keep the same time buffer for risk activities in general for the whole project. (Maxwell)</i>
Human resources involvement	The extent to which key project stakeholders, such as team members, product owners, and business unit representatives, participate in the	<i>I would need myself as a project manager plus the core team, at least for the initial assessment and I would be able to run alone</i>

	initial risk assessment and subsequent reviews.	<i>without engaging any of the team members the different reviews of the risks. (Albert)</i>
Tools and techniques usage	The degree to which the available tools and techniques, such as risk registers and SWOT analysis, are utilised in the risk management process.	<i>When I'm identifying the risks involved in a project I use a register a risk register; I can use surveys that are handed out to end users. And again, in the next phase, I will use my SWOT analysis, will go through a metrics of alignment of risk and capabilities. (Singh)</i>
Risk reviews frequency	How often the risk management activities are performed throughout the project life cycle.	<i>It is not expected that you do that risk assessment more than once at the beginning of the project. (Ashly)</i>

Table 38 Definitions and examples of participants' responses for the perceived intensity dimensions

<b>Risk management dimension</b>	<b>Definition</b>	<b>Participant quote</b>
Discipline level	The level of rigour in risk management practices, reflecting the level of commitment, responsibility, and seriousness within the risk management team.	<i>This would require a very rough and disciplined risk management practice in the project, this would you know identify how serious is the practice been taken within the working group of risk management, this would really build a discipline in terms of the accountability and responsibility of people how are owning risks. (Albert)</i>
Details and documentation	The extent of thoroughness and documentation of the risk management process	<i>If it's a high-risk project with a very strong layer of risk management, and lots of communication, lots of writing lots of documentation about risk. (Isaac)</i>
Adherence to process	The degree to which the formal practices of risk management are followed (i.e., identification, analysis, response planning, and monitoring)	<i>I need to allow the time to follow the risk management approach and the best practice outlined. So basically identifying the risks, analysing these risks, putting enough plans to mitigate it, and the implementation process and making sure I'm monitoring this all the way through that process. (Singh)</i>
Risk management approach	The approach or strategy, such as proactive or reactive, adopted to address and manage risks	<i>It's pretty much dealing with the risks as issues like whenever it's appeared and become an issue, then it's a reactive mode, rather than proactive. (Thomas)</i>

Table 39 Definitions and examples of participants' responses for the process-related activities

<b>Risk management dimension</b>	<b>Definition</b>	<b>Participant quote</b>
Risk impact and probability	The assessment of the potential severity and likelihood of occurrence of risks	<i>So the nature of business determines how escalation or how far you will go with escalation of the risk severity. (Fernando)</i>
Risk identification topics	The main topics that direct the process of identifying potential risks	<i>This would be the main two themes for triggering the identification of risks related to those two key attributes. (Albert)</i>

Risk disclosure	The degree to which risk-related information is communicated throughout an organisation	<i>We have different levels of risk awareness within our organisation where we can raise the awareness within the project or we can raise it to the level of the IT leadership team or even go higher to the executive level. (Andrew)</i>
Risk response strategies	The selection of appropriate risk response strategies for the project risks, such as accepting, mitigating, or transferring	<i>We work mainly in two dimensions, early mitigation of the risk or transferring the risk. (Albert)</i>

Most participants reported how their overall project perception (or project frame), such as whether it is a low-risk project, high-risk project, or light-tough project, influences their engagement with risk management. For example, when the project frame is a low-risk project (positive project frame), 5% or less of the project budget is allocated for risk management, whereas for a high-risk project (negative project frame), 20% or more is allocated. In all cases, the technical and perceived intensity of risk management is low when the project frame is positive, whereas it is high when the project frame is negative.

For projects with a positive frame, project managers tend to allocate a small proportion of the project's budget and duration to risk management, ranging from 1 to 10% on average. Human resources involvement in risk management is typically limited, with only the core project team and a few client representatives participating in the initial risk assessment, but subsequent reviews are typically administered by project managers. There is a tendency to rely on predefined risk lists rather than utilising all available tools. Compliance with formal risk management processes is not always rigorous, and some project managers believe that carrying out each step is unnecessary. The risk management process is often not meticulous, with little documentation. Most project risks are accepted, and risk awareness is generally confined within the project team. Finally, the approach to risk management is often informal or ad hoc, based on lessons learned from previous projects. Some examples of participants' responses are given below:

*So if the project is a light touch from the early beginning, only budget around one 1% to 2% for the risk management. It's minimum, it's almost minimum almost none, which for example, there is no workshop for risk management. I'm not going through the probability of each risk and the severity for each risk and then identify the score. There is no risk response plan or reports or something like that. (Thomas)*

*So, the way we would answer mitigate the risk would be through building contingency into the budget. So low risk project typically is less than 10% contingency. (Sara)*

*For the positive project, so I'll be intending to get you know, a blended team junior and seniors because actually the unknowns are really few. (Maxwell)*

*Yeah. So as I mentioned beginning this is actually in the budget it's 10% five to 10% and normally I keep the same time buffer for risk activities in general for the whole project, again, this is from those are the projects which I have positive perception or positive view on it. (Maxwell)*

*So, if it is a low severity project, maximum I can go for 5% of the project budget for risk management. (Andrew)*

*For low severity projects, most of the risks we tend to accept the risks because mainly this is a low severity project. (Andrew)*

For projects with a negative frame, project managers tend to allocate a greater proportion of the project's budget and duration to risk management, ranging from 10% to 25% on average. Human resources are more heavily involved, including the core team, subject matter experts, and a wide variety of stakeholders such as end-users, product owners, and business unit representatives. The use of various risk management tools and techniques, such as surveys and risk registers, is common. There is strong adherence to the full risk management process. There is extensive documentation regarding the risks. Risk response strategies often involve early risk mitigation or transferring extremely complex risks. Risk awareness extends to the executive level, and regular meetings are scheduled to monitor risks. Finally, a proactive approach to managing risks is typically adopted. Some examples of participants' responses are given below:

*With our contingency for a complex project, as I've said before, when I put a contingency is somewhere between 15 to 20%. So if I'm planning a contingency plan of my delivery of the project, and the overall time spend on this project is likely to increase because now, I've identified that I'm going to follow the full risk management approach outlined and best practices. So I need to get the right people involved. I need to build a team of risk management team. (Singh)*

*While in a negative perception, I'll tend more to get more experienced people, more subject matter experts in the area because the unknowns are high and definitely would need a lot of experience to navigate through the project and identify the risks as early as possible and mitigated that of course. (Maxwell)*

*My view on the project will definitely guide a bit the pace of review of the whole activities and make sure that we are running each individual phase of the risk identification and risk mitigation through the whole, you know, steps that we described above. If this is really if my view of the project is really negative, then I will do really every single step here. (Maxwell)*

*So on a very risk centric project, you know, in extreme cases, and not so much in software development, but an extreme cases where maybe lives are at risk, you might have a very*

significant proportion, let's say 50% of the project, maybe even higher, in some cases might be about managing risk. (Isaac)

If it's a high project, then it's a different story. I would assume that I would need more than 20% could be 20% of the budget allocated for risk management or at least 10% of the project duration allocated for it. And I would need the project manager and the core team in all the risk management assessments the initial one and the frequent and subsequent risk assessment and risk meetings. (Albert)

If it is a severe project, I do my best to get approvals for 20% of the project budget. (Andrew)

If it is a very high severity project we work mainly in two dimensions, early mitigation of the risk or transferring the risk. Early mitigation of the risk means like if I see a risk of skill set for example, I don't wait till that we have the problem and start dealing with it. Or maybe if something that is very complicated and we cannot handle it internally, we think about transferring the risk by having a third party or one of our suppliers to deliver the project as a turnkey solution. (Andrew)

Table 40 illustrates how the effects of project frames on risk management were elicited from the participants' responses. Furthermore, Table 41 aggregates the project frames by their types (i.e., positive, neutral, and negative) and illustrates their effect on the various risk management dimensions.

Table 40. Illustration of how the effects of project frames on risk management were elicited

Participant quote	Project frame	Project frame type	Risk management dimensions
<i>If I'm about to run a low-risk project,<sup>1</sup>I would expect that I need to assign like maybe less than 5% of the budget for this for the practice. <sup>2</sup>Maybe up to 1% could be from the project duration to the activities for risk management. And for that, <sup>3</sup>I would need myself as a project manager plus the core team, at least for the initial assessment and I would be able to run alone without engaging any of the team members the different reviews of the risks. (Albert)</i>	Low-risk project	Positive, low risk	<sup>1</sup> Funding <sup>2</sup> Time investment <sup>3</sup> Human resources involvement
<i>For medium severity project, we can go up to the level of IT leadership team to help us to manage this risk or how to overcome this risk. (Andrew)</i>	Medium severity project	Neutral, medium risk	<sup>1</sup> Risk disclosure
<i>If it's a high-risk project with a very strong layer of risk management, and <sup>1</sup>lots of communication, lots of writing lots of documentation about risk and where we're at. And that becomes very obvious if you're doing it in a deep way. (Isaac)</i>	High-risk project	Negative, high-risk	<sup>1</sup> Details and documentation
<i>In the very lightest touch projects, you know, we might try and <sup>1</sup>spend very little on risk management, you know, almost negligible, you know, 1% 5%, maybe it's close to zero. (Isaac)</i>	Lightest touch project	Positive, low risk	<sup>1</sup> Funding

<i>Very different from a complex project where <sup>1</sup>I'm going through every single phase of risk identification, and risk analysis and planning for these risks that I've found. And when I've implemented them, how did that mitigate these risks? And a course all these four phases are monitoring these risks through that whole lifecycle. (Singh)</i>	Complex project	Negative, high-risk	<sup>1</sup> Adherence to process
<i>Note: In the examples presented above, superscripted numbers are used to connect the risk management dimensions mentioned by participants to their respective coded segments.</i>			

Table 41. Effect of project frames on risk management engagement

Type of project frame	Risk management dimensions	Project frame effect
Positive, low risk	Funding	5% or less of the project's budget. A maximum of 5% of the project's budget. 5–10% of the project's budget. 1–5% of the project's budget 10% or less of the project's budget. 5% of the project's budget.
	Time investment	1% of the project's duration. 5–10% of the project's total time. 5% of the project's time.
	Human resources involvement	The core team participates in the initial risk assessment but is not involved in subsequent risk reviews. Involving a group of juniors and seniors in risk management. Only the project team and 2 or 3 people from the client site are involved.
	Tools and techniques usage	Not using all tools and techniques, instead relying primarily on predefined risk lists.
	Adherence to process	It is not necessary to do every step of risk management. Not adhering to the recommended risk management practices.
	Details and documentation	The process of risk management is not meticulous. There is little risk documentation.
	Risk response strategies	Most project risks are being accepted.
	Risk disclosure	Risk awareness is within the project team.
	Risk management approach	Adopting an ad hoc risk management approach (assuming risks and mitigation plan based on lessons learned from previous projects).
	Neutral, medium risk	Funding
Time investment		3% to 5% of the total project time.
Human resources involvement		Involving the core team in the initial risk assessment and the owners of key risks in the follow-up risk reviews.
Risk disclosure		Risk awareness is raised to the level of the IT leadership team.
Negative, high-risk	Funding	5% to 8% of the overall budget. 20% or more of the project's budget. 20% of the project's budget. 20% maximum of the project's budget. 10%–20% of the project budget, and in extreme cases, 50%.

		More than 25% of the project budget; this percentage increases as the project's scope becomes less clear.
	Time investment	10% or more of the total project time. 15% (plus or minus) of the project's total time. 15–20% of the project's total time. A significant amount of time is devoted to discussing risks and risk management.
	Human resources involvement	Involving the core team in the initial risk assessment and subsequent risk reviews. Engaging more experienced people or subject matter experts in risk management. Engaging a large number of individuals in risk management, such as end users, project managers, product owners, and business unit representatives.
	Tools and techniques usage	Using a variety of tools and techniques, such as surveys and risk registers.
	Adherence to process	There are risk management workshops, risk scoring, risk response plan and risk reports. Every risk management step is carried out. There is adherence to the full risk management process. Performing all phases of risk management, including identification, analysis, response planning, response implementation, and monitoring.
	Details and documentation	Extensive documentation regarding risks.
	Adherence to process	Risk management is important for the project.
	Risk response strategies	Early risk mitigation or transfer of extremely complex risks.
	Risk disclosure	More risk awareness is present at the executive level.
	Risk reviews frequency	Meetings to monitor risks are regularly scheduled.
	Risk management approach	A proactive approach is adopted to managing risks.

Other participants suggested that a single attribute, whether framed positively or negatively, could affect specific dimensions of risk management engagement. For example, when the customer relationship is good (positive frame), the probability of engaging in the risk management process is low. Another example is that when the project criticality is high (negative frame), most of the risks that will be raised will have a greater perceived impact. Furthermore, it was revealed that the negative framing of attributes (e.g., complexity of business processes, project outcome materiality, and regulatory and contractual obligations) results in a greater technical and perceptual intensity of risk management than the positive framing. However, the negative framing of the project budget and project time attributes reduces the intensity of risk management compared to the positive framing. Some examples of participants' responses are given below:

*If the project is, is really classified as mission critical, this would require a very rough and disciplined risk management practice in the project, this would really build a discipline in terms of the accountability and responsibility of people how are owning risks. (Albert)*

*When we are dealing with a high mature client or vendor, yes, the risk management practices are being taken care of and it's really taken seriously. (Albert)*

*However, if it's a low maturity project management organisation or the maturity of the client is really low usually risk management is not taken into consideration. (Albert)*

*It will obviously, the more complicated the business processes supported or the business outcome, the more the risk management budget you will need. (Ashly)*

*And definitely the larger the project, the larger the need of risk management because the larger the areas that you're going to touch delivering this project and the more probability of having issues coming from that area. (Fernando)*

*If the company has a low-risk appetite, meaning that more risk is likely to be recorded and it also means that risk mitigation mitigating actions are more likely to be reviewed more regularly. (Sara)*

Table 42 illustrates how the effects of a single framed attribute on risk management were elicited from the participants' responses. Furthermore, Table 43 shows how each attribute affects the various dimensions of risk management, as well as its frames and frame type.

Table 42. Illustration of how the effects of a single framed attribute on risk management were elicited from the participants' responses.

<b>Participant Quote</b>	<b>Attribute</b>	<b>Attribute frame</b>	<b>Frame type</b>	<b>Risk management dimensions</b>
<i>If the project criticality is high, then pretty much <sup>1</sup>any risk or most of the risks that we will going to raise a team, the severity for each risk will be high. (Thomas)</i>	Project criticality	Project criticality is high	Negative	<sup>1</sup> Risk impact and probability
<i>Project which could be classified as business as usual or normal operational system. <sup>1</sup>This definitely does not have or should not have the huge budget or dedicated resources to work on risk management practice. (Albert)</i>	Project outcome materiality	Project which could be classified as normal operational system	Positive	<sup>1</sup> Funding <sup>2</sup> Human resources involvement
<i>If you just have a very tight budget, <sup>1</sup>you just go into the basics of risk management and determine the clear ones to the project. (Fernando)</i>	Project budget	Very tight budget	Negative	<sup>1</sup> Details and documentation
<i>The more friendly relation <sup>1</sup>leads to less probability of having a risk management because if you work before with the customer with a good relation you tend to work as one team. (Fernando)</i>	Relationship with customer	Customer with a good relation	Positive	<sup>1</sup> Adherence to process
<i>The more complicated the legal, regulatory and contractual obligations, the more complicated the risk assessment</i>	Regulatory and	The more complicated the legal,	Negative	<sup>1</sup> Human resources involvement

<i>sizing requirements will be in the risk management activities will be and obviously the skills required. So you would obviously need subject matter experts who understand those requirements within the different contexts. (Ashly)</i>	contractual obligations	regulatory and contractual obligations		
<i>Note: In the examples presented above, superscripted numbers are used to connect the risk management dimensions mentioned by participants to their respective coded segments.</i>				

Table 43. Effect of single framed attribute on risk management engagement

<b>Attribute</b>	<b>Attribute frame</b>	<b>Frame type</b>	<b>Risk management dimensions</b>	<b>Single attribute effect</b>
Project budget	Very tight budget	Negative	Details and documentation	The basics of risk management are carried out (identifying only foreseen risks rather than all risks).
	Enough room in the budget	Positive	Details and documentation	It is possible to conduct more thorough risk management and identify more risks.
Complexity of business processes	It [business processes] is not well defined and documented	Negative	Time investment	More time is needed to manage project risks.
	The more complicated the business processes supported	Negative	Funding	Funding for risk management is increased.
Organisation maturity	Low-maturity project management organisation	Negative	Adherence to process	No attention is paid to risk management.
	High mature client or vendor	Positive	Adherence to process	Risk management is given serious consideration.
Relationship with customer	There is no relation at all	Negative	Adherence to process	Engagement in the risk management process is necessary.
	Customer with a good relation or friendly relation	Positive	Adherence to process	The likelihood of engaging in the risk management process is low.
	The more friendly relation with the customer	Positive	Adherence to process	The probability of engaging in the risk management process is low.
Project outcome materiality	Project is classified as mission critical	Negative	Discipline level	Risk management needs to be rigorous and emphasise accountability and risk ownership.
			Details and documentation	Risk management must be done in great detail.
	The more complicated the business processes supported or the business outcome	Negative	Funding	Funding for risk management is increased.
	Project which could be classified as	Positive	Funding	Risk management procedures should not

	business as usual or normal operational system			require a substantial budget.
			Human resources involvement	Risk management do not require substantial resources.
			Discipline level	Risk management might be taken lightly.
Project criticality	Project criticality is high	Negative	Risks impact/probability	Most of the risks that will be raised will have a greater perceived impact.
Regulatory and contractual obligations	The more complicated the legal, contractual and regulatory obligations	Negative	Risks impact/probability	Raising the perceived impact of financial risks.
	The more complicated the legal, regulatory and contractual obligations	Negative	Human resources involvement	Subject matter experts (e.g., legal experts) are needed to participate in risk management.
	Regulations were not so complicated	Positive	Details and documentation	Risk management can be carried out with fewer details.
Project size	The larger the project	Negative	Adherence to process	There is a greater need to engage in the risk management process.
Stakeholders' appetite	Organisation that has higher appetite	Positive	Risks impact/probability	Risk should not be overstated for risk-taking organisations.
	High risk appetite	Positive	Time investment	Low percentage of project administration time is allocated to risk management activities.
	Organisation that has a lower appetite	Negative	Risks impact/probability	Risk should not be minimised for risk-averse organisations.
	Company has a low-risk appetite	Negative	Details and documentation	A greater number of risks will likely be recorded.
Risk reviews frequency			Risk mitigation actions are more likely to be reviewed on a regular basis.	
Team skills and experiences	The less experience [team]	Negative	Adherence to process	There is a greater need for risk management.
	The more experience [team]	Positive	Adherence to process	Risk management is not as necessary.
Project time	Time does not allow	Negative	Adherence to process	Not carrying out risk management activities, instead dealing with issues as they arise.

In a few cases, participants described how a group of framed attributes could influence specific risk management dimensions. For example, when the time and budget are tight (negative frame), risk management is performed only once at the start of the project. Table 44 illustrates how the effects of a group of framed attributes on risk management were elicited from the participants' responses. Furthermore, Table 45 illustrates how each attribute group affects the various dimensions of risk management, along with their respective frames and frame types.

Table 44. Illustration of how the effects of a group of framed attributes on risk management were elicited

Participant Quote	Attributes	Attribute frames	Frame type	Risk management dimensions
<i>Based on my initial assessment to each one of them, what would be the weight of each of those attributes to the overall project risks? I will build my initial assessment that maybe budgets timeline are the key areas where I should be worried about and this is, yeah, this would be the main two themes for triggering the identification of risks related to those two key attributes. (Albert)</i>	High-weight attributes (e.g., budget and timeline)	Budgets timeline are the key areas	Negative	<sup>1</sup> Risk identification topics
<i>If you have a tight time and budget for a complex project that requires significant business outcomes, <sup>1</sup>that will obviously immediately increase the risks for that project the probability and impact of the risks of that project. (Ashly)</i>	Project time, Project budget, Project outcome materiality	Tight time and budget and significant business outcomes	Negative	<sup>1</sup> Risks impact/probability
<i>If we think of a software project that has tightened time and tightened budget, <sup>1</sup>it is not expected that you do that risk assessment more than once at the beginning of the project. (Ashly)</i>	Project time, Project budget	Tightened time and tightened budget	Negative	<sup>1</sup> Risk reviews frequency
<i>If you have enough budget and time, <sup>1</sup>then you are unlikely to have the luxury of reducing the risks to the least possible value. (Ashly)</i>	Project time, Project budget	Enough budget and time	Positive	<sup>1</sup> Risk response strategies
<i>Note: In the examples presented above, superscripted numbers are used to connect the risk management dimensions mentioned by participants to their respective coded segments.</i>				

Table 45. Effect of a group of framed attributes on risk management engagement

Attributes	Attribute frames	Frame type	Risk management dimensions	Group of attributes effect
Any attributes	Key attributes	Negative	Risk identification topics	Key attributes are the main themes for triggering risk identification.
	Attributes that are important	Negative	Risks impact/probability	Focusing on identifying risks perceived to have negative effect on project success factors.
	Highest priority attributes	Negative	Risks impact/probability	Raising the perceived impact of risks associated with the highest priority attributes.
Project time, Project budget, Project outcome materiality	Tight time and budget and significant business outcomes	Negative	Risks impact/probability	Raising the perceived probability and impact of project risks.
Project time, Project budget	Tightened time and tighten budget	Negative	Risk reviews frequency	Risk management is performed only once, at the start of the project.

	Project is multiple years and with a larger budget	Negative	Risk reviews frequency	Risks are revisited through a series of risk management workshops.
	Don't have time and don't have budget	Negative	Response strategies selection	Accepting some project risks.
	Enough budget and time	Positive	Risk response strategies	Having the ability to minimise risks to the least possible level.

#### 4.7 Framing Change

The findings in this section related to how project framing changes over time, during project lifecycle. Some participants indicated that the initial evaluation of attributes could change over the course of the project's lifecycle. Consequently, this may alter their perception of the project and influence their engagement in risk management. Some examples are given below:

*Definitely the attributes need to be tracked throughout the product lifecycle and they could heavily impact the risk management if they change. (Ashly)*

*We might start with a particular view about the risk profile and the investment that the sponsor is going to make in managing that risk. And it may be there's as more information as discovered during the execution of the project as a time comes for a review and a decision to change the risk profile and to change the project plan and the level of investment either upwards or downwards, in the amount of risk in the remaining part of the project. (Isaac)*

Table 46 presents examples illustrating how the change in attribute framing affects risk management by showing the trigger of the framing change, the attribute affected, and the framing change effect. The project framing may change throughout the project life cycle as a result of critical events such as a change in management or business direction, the departure of a member(s) of the project team with expertise in such projects, a change in project scope, a change in target timelines, an increase or decrease in project outcomes, and the introduction of new legal and regulatory requirements. For example, if a member of the project team with a high level of expertise in development technology resigns, the project manager may increase the project's risk severity and the contingency budget for managing risks. A second example is that if the project outcomes increase or change, such as adding health and safety requirements to a visitor tracking system, the whole risk management process should be revisited because new risks must be identified, and existing risks must be assessed. Finally, the view of the project could change from being a heavily engaged project management project (negative frame) to a light-touch project management project (positive frame) if the project scope is reduced and project timelines are loosened.

Table 46. Effect of framing change on risk management engagement

<b>Participant Quote</b>	<b>Trigger of framing change</b>	<b>Attribute affected</b>	<b>Effect of framing change</b>
<i>Resource skill set was expert in a specific technology. He resigned especially latest COVID situation and cannot be covered within the existing resources. So, I need to ask this will change the severity too high and because the resources existing are not fitting for the purpose and I need to ask for contingency additional contingency budget. (Andrew)</i>	A team member who is an expert in the technology used to build the project resigned.	Team skills and experience	Increasing the overall project risk and requiring an additional contingency budget.
<i>If the business outcomes increase or change as where the project is being delivered, then obviously, the whole risk management process has to be revisited. So things like risks need to be re-assessed based on the new expected business outcomes. (Ashly)</i>	The project outcome increased or changed.	Project outcome materiality	Reviewing the risk management process (e.g., reassessing risks)
<i>You can start building a core banking system when the regulation is in one place, and then after just a few months from the start of that project. The Reserve Bank or equivalent financial authority would may or could change that regulation and accordingly, introduce new risks or change the ratings of existing risks for that project just because of the introduction of that new regulatory requirements. (Ashly)</i>	The financial authority changed the regulations.	Regulatory and contractual obligations	New risks should be identified, and existing risk ratings should be revised.
<i>When you have a heavily engaged project management, I didn't see it to be turn to a light touch. It will continue as heavily engaged unless the scope is for example reduced. And then you know, or you know, you have any of the constraints got revisited either the timeline changed, the target timelines changed to be more relaxed or something like that. This, you know, might revert the project to be from the heavily engaged to light touch.</i>	Project scope is reduced; project timelines changed was to be more relaxed	Project scope and project time	The project view is changed from a heavily engaged PM project (negative frame) to a light-touch PM project (positive frame)

#### 4.8 Chapter Summary

In this chapter, the findings were presented according to the final coding template created in the data analysis. Five major findings emerged from this study. First, participants form a perception of a project based on objective attributes (e.g., project budget) and subjective attributes (e.g., project complexity). Second, to evaluate these attributes, participants use different reference points obtained from past experience of managing similar projects or the information acquired during the evaluation process. Third, the evaluated attributes form the project framing, which participants express by describing the attributes in positive or negative terms (i.e., attribute framing). Fourth, participants' engagement in risk management is influenced by the compound evaluation of attributes (i.e., the project frame), a single attribute, or a group of attributes. Fifth, the evaluation of attributes could change over the project lifecycle and influence engagement in

risk management. The next chapter discusses the findings in the context of the literature on behavioural IS risk management and framing effects.

## Chapter 5: Discussion and Conclusion

### 5.1 Chapter Overview

This chapter provides a detailed discussion of the study findings presented in Chapter 4. This chapter begins by providing a summary of the main findings in relation to the research questions outlined in Chapter 1. Next, it discusses how the study findings extend behavioural research on IS project risk management and how this study contributes to the broader literature on framing in IS project management, as well as to the foundational theory used in this study and to practice. This chapter ends with a brief concluding summary.

### 5.2 Summary of Key Findings

This study examined how IS project managers subjectively interpret project information (i.e., project framing) and how this influences their engagement in risk management. A total of 26 semi-structured interviews were conducted with project managers in various IT/IS companies in New Zealand. The data was analysed using the template analysis style of thematic analysis. Table 47 provides a summary of this study's findings for each research question.

Table 47. Summary of key findings

Research Questions	Findings
<i>Research Question 1:</i> How do IS project managers develop the framing of a project?	<ul style="list-style-type: none"><li>• The framing of a project is developed using attribute framing. It involves two types of attributes: objective attributes that are directly associated with objective facts about a project (e.g., project budget and time) and subjective attributes that are based on the personal judgement of IS project managers (e.g., project criticality and complexity).</li><li>• These attributes are assessed using different reference points, which arise from either project managers' past experience or information acquired during the development of the project framing.</li></ul>
<i>Research Question 2:</i> How does IS project managers' project framing influence their engagement with risk management?	<ul style="list-style-type: none"><li>• The project framing influences engagement in risk management through the project frame, a single framed attribute, and/or a group of framed attributes.</li><li>• Risk management engagement includes several dimensions: technical intensity, such as funding and time investment; perceived intensity, such as discipline level and adherence to process; and process-related activities, such as risk impact and probability and risk identification topics.</li></ul>

First, the framing of a project is formed based on various attributes. These attributes can be classified into two categories: objective and subjective. Objective attributes are directly associated with objective facts about a software project, such as budget, scope, time, and technology. Subjective attributes, on the other hand, are based on the personal judgement of IS project

managers and include project criticality, project complexity, and project outcome materiality. In addition, these attributes are assessed using a variety of reference points, which are comparative standards against which the attributes are evaluated or measured. There are two sources of reference points: internal and external. Internal reference points are retrieved from memory and formed based on project managers' past experience. External reference points are obtained from the information acquired during the development of the project perception.

Second, the framing of a project influences engagement in risk management through (1) the project frame, which is the compound evaluation of the attributes, (2) a single framed attribute, and/or (3) a group of framed attributes. Furthermore, risk management engagement includes several dimensions: technical intensity, such as funding, time investment, and human resources involvement; perceived intensity, such as discipline level, details and documentation, and adherence to process; and process-related activities, such as risk impact and probability, risk identification topics, and risk response strategies.

In all cases, the technical and perceived intensity of risk management is low when the project frame is positive, whereas it is high when the project frame is negative. Likewise, the negative framing of attributes (e.g., complexity of business processes, project outcome materiality, and regulatory and contractual obligations) results in a greater technical and perceived intensity of risk management than the positive framing. However, the negative framing of the project budget and project time attributes reduces the intensity of risk management compared to the positive framing.

### **5.3 Expanding Our Understanding of IS Project Risk Management**

This study contributes to the field of IS project risk management. Much of the prior research on IS project risk management has focused on developing normative prescriptions, including risk checklists (e.g., Addison, 2003; Menezes et al., 2019; Verner et al., 2014), risk frameworks (e.g., Chadli & Idri, 2017; Wallace & Keil, 2004), process models (e.g., Boehm, 1991; PMI, 2017), and risk mitigation strategies (e.g., Nidhra et al., 2013; Yogi & Patil, 2018). However, risk management researchers have long stressed that IS project managers do not always use these prescriptions (e.g., Papke-Shields et al., 2010; Varajão et al., 2017), with some researchers concluding that actual risk management is distinctively different from prescriptions in the literature (Kutsch et al., 2014; Taylor, 2005). This may be due to the fact that the assumptions underlying many risk management prescriptions differ from how IS project managers perceive and respond to risk (Moeini & Rivard, 2012). In a recent review article, Moeini and Rivard (2019b) asserted that there are few studies attempting to explain why IS project managers deviate from normative prescriptions of risk management. Therefore, advancing experiential knowledge

of risk management contributes to the development of more reliable normative prescriptions, thereby enhancing their acceptability.

Adopting a behavioural stance, researchers have examined the effect of IS project managers' beliefs (e.g., fact, competence, and authority) (Kutsch et al., 2013) and mental construals (i.e., abstract and concrete) (Lee et al., 2019; Shalev et al., 2014) on their engagement with risk management, as well as what affects their risk perception (e.g., Du et al., 2006; Jani, 2011; Keil et al., 2000; Liu & Yuliani, 2016). However, to our knowledge, this study is the first to look at how IS project managers' project framing influences their engagement with risk management.

Figure 5 presents the conceptual model derived from this study, which illustrates how project framing influences risk management engagement. As shown in this figure, risk management engagement is affected by (1) the project frame, which is the compound evaluation of the attributes; (2) a single framed attribute; and/or (3) a group of framed attributes. Table 48 shows an example of the effect of project framing on risk management engagement for the case "Albert". The project manager mentioned that his project frame (i.e., low-risk project, medium-risk project, and high-risk project) affects the technical intensity dimensions of funding, time investment, and human resources involvement. In addition, the "project outcome materially" attribute affects the perceived intensity dimension of discipline level. Furthermore, the negatively framed attributes impacting stakeholders' project success factors his engagement with the risk identification activity. Another example is shown in Table 49. In this case, the project manager said that his project frame (i.e., light-touch PM project and highly-involved PM project) affects the technical intensity dimension of funding and the perceived intensity dimension of adherence to process. In addition, the "project criticality" attribute affects his engagement with the risk analysis activity.

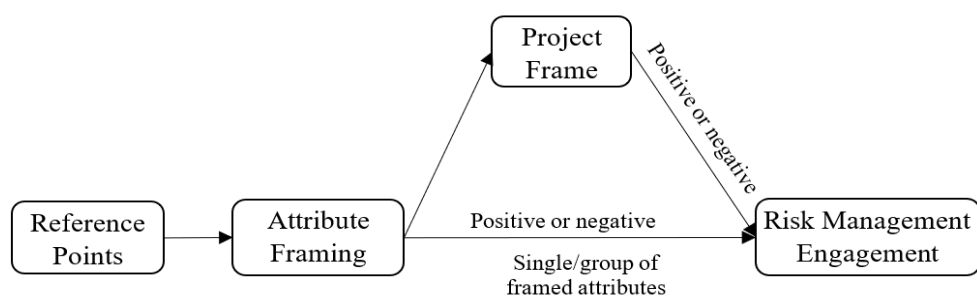


Figure 5. The model of the effect of project framing on risk management engagement

Table 48. Example of the effect of project framing on risk management engagement for case “Albert”

<b>Project frame effect</b>	<b>Single-framed attribute effect</b>	<b>Group of framed attributes effect</b>
<p>His project frame affects the RM dimensions of funding, time investment, and human resources involvement as follows:</p> <ul style="list-style-type: none"> <li>• Positive/low-risk project: 5% or less of the project’s budget; 1% of the project’s duration; the involvement of the RM team only in the initial risk assessment.</li> <li>• Neutral/medium-risk project: 10% maximum of the project’s budget; 3% to 5% of the project’s duration; the involvement of the RM team in the initial risk assessment and the owners of key risks in the follow-up risk reviews.</li> <li>• Negative/high-risk project: 20% or more of the project’s budget; 10% or more of the project’s duration; the involvement of the RM team in the initial risk assessment and subsequent risk reviews.</li> </ul>	<p>The “project outcome materially” attribute affects the “discipline level” dimension:</p> <ul style="list-style-type: none"> <li>• Negative frame “mission-critical system”: risk management needs to emphasise accountability and risk ownership.</li> <li>• Positive frame “normal operational system”: risk management might be taken lightly.</li> </ul>	<p>Negatively framed attributes will be the main topics for risk identification.</p>

Table 49. Example of the effect of project framing on risk management engagement for case “Thomas”

<b>Project frame effect</b>	<b>Single-framed attribute effect</b>	<b>Group of framed attributes effect</b>
<p>His project frame affects the RM dimensions of funding and adherence to process as follows:</p> <ul style="list-style-type: none"> <li>• Positive/ light-touch PM project: 1-2% of the project’s budget; there is no risk scoring, risk response plan, or risk report.</li> <li>• Negative/ highly-involved PM project: 5-8% of the project’s budget; there is risk scoring, a risk response plan, and reports to the management.</li> </ul>	<p>The “project criticality” attribute affects the “risk impact/probability” dimension. So, if the project criticality is high, the project manager will increase the perceived impact of most of the identified risks.</p>	<p>None</p>

Project framing is important since it can be indicative of IS project managers’ risk perception (Sitkin & Pablo, 1992) as well as it encompasses the rationale or argument that justifies their actions (Mähring & Keil, 2008). Thus, analysing project managers’ project framing can improve our understanding of their behaviour and decision-making in managing risk. Table 50 shows a comparison between the assumptions underlying normative studies on IS project risk management and the actual behaviour of IS project managers that this study observed.

Table 50. Comparison between normative studies’ assumptions and IS project managers’ actual behaviour

<b>Normative prescriptions’ assumptions</b>	<b>Supporting literature</b>	<b>IS project managers’ assumptions</b>
<p>An objective assessment of risk is the only source of information for project managers to make a decision about risk.</p>	<p>Neumann and Morgenstern (1974);</p>	<p>IS Project managers’ perceptions of risk are influenced by the project frames they develop subjectively; positive frames lead project managers to perceive low project</p>

	Moeini and Rivard (2012)	risks, while negative frames result in high project risks.
Risk management engagement is a binary choice of whether to engage in or disengage from formal practices.	Moeini and Rivard (Moeini & Rivard, 2019b); Kutsch and Hall (2009); Kutsch et al., (2013)	Risk management engagement is a continuum along which IS project managers determine the intensity of practices, including technical aspects such as funding and time and perceived aspects such as discipline level and details/documentation.
IS project managers will apply formal risk management practices.	Boehm (2002); Wallace and Keil (2004); de Bakker et al. (2011); PMI (2017)	IS project managers sometimes disengage from formal practices when they have a positive view (frame) of a project; also, when the relationship with the customer is good, the project team's experience is high, the organisation's maturity is low, or the project size is small.
IS project managers should identify all possible risks affecting the project.	Boehm (2002); PMI (2017); Masso et al. (2020)	IS project managers sometimes tend to focus on specific topics, resulting in limiting the range of risks to be considered; negatively framed attributes can be used as the main topics for risk identification.
Project managers will compute the extent of expected disutility/impact due to risk using some formula or rules of logic.	Neumann and Morgenstern (1974); Moeini and Rivard (2012); PMI (2017)	IS project managers' project framing affects their risk impact assessment; for instance, they may increase the perceived impact of risks associated with negatively framed attributes.
IS project managers will enact risk responses because they are important for project success.	Boehm (2002); Barki et al. (2001); Nidhra et al. (2013); Yogi and Patil (2018)	Positive project framing may lead IS project managers to not enact risk responses compared to negative project framing.
IS project managers will regularly monitor risks, reassigning existing risks and identifying new ones.	Boehm (2002); PMI (2017); Masso et al. (2020)	Fewer risk review meetings are regularly scheduled when IS project managers have a positive project frame compared to a negative one; also, when project time and budget are tight and when stakeholders' risk appetite is low.

The assumption of project managers' perception of risk underlying the normative prescriptions in the IS project risk management literature differs from the actual perception of risk. It is assumed that an objective assessment of risk is the only source of information for project managers to make a decision about risk (Moeini & Rivard, 2012; Neumann & Morgenstern, 1974). However, this study reveals that IS project managers' perception of project risk is influenced by how the situation (i.e., a project) is framed. In other words, the subjective project frames being developed by IS project managers affect their perception of risk associated with a project. IS project managers develop subjective project frames based on a set of attributes, which are evaluated or framed using different reference points. As such, a project frame consists of a set of positively or negatively framed attributes. Furthermore, the findings show that IS project managers with a positive project frame perceive low project risks, whereas those with a negative project frame perceive high project risks. The theory on attribute framing (Levin & Gaeth, 1988) indicates that

attribute framing can influence how people evaluate the object in question (e.g., a project), with positive framing of attributes leading to more favourable evaluations of the target object than negative framing. Therefore, this study demonstrates that the more positively framed attributes are, the more positively the project is perceived and the lower the perceived risk; conversely, the more negatively framed attributes are, the more negatively the project is perceived and the higher the perceived risk.

Prior research on IS project risk management views “risk management engagement” as a binary choice of whether to engage in or disengage from formal processes (i.e., risk planning, risk identification, risk analysis, risk response, and risk monitoring) (Kutsch et al., 2013; Kutsch & Hall, 2009; Moeini & Rivard, 2019b). However, the findings of this study revealed that risk management engagement is a continuum along which IS project managers determine the intensity of risk management processes. In this regard, two new concepts appeared: technical intensity and perceived intensity. Technical intensity refers to the quantitative or measurable factors of risk management, which include funding, time investment, human resources involvement, tools and techniques usage, and risk review frequency. Perceived intensity refers to the behavioural aspects that influence how rigorously or seriously risk management is perceived, which include discipline level, details and documentation, adherence to process, and risk management approach.

Deciding how much time and other resources are required for risk management is fundamental to IS project managers’ daily practice (PMI, 2017). Prior research suggests that IS project managers with an abstract mental construal of a project risk perceive less effort and resources required for risk management than those with a concrete mental construal (Keil & Lee, 2019). This study extends these findings by showing that IS project managers with positive project frames tend to reduce the technical intensity of risk management (i.e., funding, time investment, human resources involvement, and tool and technique usage), while those with negative project frames tend to increase this intensity.

Based on this study’s findings, a project manager reported that when he has a positive perception of a project, he allocates 5–10% of the project’s budget and time and involves a group of juniors and seniors in risk management; when he has a negative perception, the percentage of the project budget could be raised to 20%, 15% (plus or minus) of the project’s time, and engaging more experienced people or subject matter experts in risk management. Similarly, a project manager mentioned that for a positive project perception, 5% of the project’s budget and time are allocated, only the project team and 2 or 3 people from the client site are involved, and not all tools and techniques are used, instead relying primarily on predefined risk lists. In contrast, for a negative project perception, 15–25% of the project’s budget and time are allocated, a large number of individuals (e.g., end users, product owners, and business unit representatives) are engaged, and a variety of tools and techniques (e.g., surveys and risk registers) are used. In another case, a

project manager decides on these dimensions based on the attributes of complexity of business processes, project outcome materiality, and regulatory and contractual obligations. Thus, the project manager stated that the more complicated the business processes or the project outcome, the more time and budget are required for risk management; in addition, when regulatory and contractual obligations are complicated, subject matter experts (e.g., legal experts) are needed to participate in risk management.

Normative studies assume that IS project managers will regularly monitor risks, reassigning existing risks and identifying new ones (Boehm, 1991). However, this study reveals that risk review frequency is influenced by IS project managers' framing. A project manager mentioned that when he has a positive project perception, meetings to monitor risks are less regularly scheduled than when he has a negative project perception. Furthermore, the findings also reveal that risk management is only performed once, at the beginning of the project, when the project time and budget are tight; in contrast, risks are revisited through a series of risk management workshops when the project time and budget are sufficient. In addition, if stakeholders' appetite for risk is low, risk mitigation actions are more likely to be reviewed on a regular basis than if stakeholders' appetite is high.

Given the long-standing question of why IS project managers disengage from formal risk management practices, previous research suggests some reasons for such disengagement, such as cost justifiability, the problem of anxiety, and lack of authority (Kutsch et al., 2013; Kutsch & Hall, 2009, 2010). Furthermore, this study reveals that disengagement may be caused by the project frames being developed subjectively by IS project managers. In some cases, IS project managers argued that when they have a positive view (frame) of a project, it is not necessary to do every step of the risk management process. In addition, by analysing the effects of single attributes, IS project managers may disengage with risk management if the relationship with the customer is good, the project team's experience is high, the organisation's maturity is low, or the project size is small.

Normative prescriptions of risk management focus on the technical aspects of risk management engagement, such as funding, timing, and reporting formats (PMI, 2017). However, this study reveals that IS project managers also focus on other dimensions, such as the perceived level of discipline and intensity of details and documentation for risk management. The findings reveal that when IS project managers have a positive project view, they are unwilling to invest time and resources in detailed, documented risk management, but when they have a negative project view, they document risks extensively. Furthermore, the findings show the effects of individual attributes such as project outcome materiality, regulatory and contractual obligations, and stakeholder risk appetite. Risk management must be detailed, rigorous, and emphasise accountability and risk ownership when the project outcome is framed as a "mission-critical

system”, whereas risk management may be taken lightly when it is framed as a “normal operational system”. Risk management can be carried out with fewer details when regulatory and contractual obligations are not complicated. When stakeholder risk appetite is low, a greater number of risks are likely to be recorded.

Prior research indicates that IS project managers were unwilling to expose stakeholders to risks because this may create anxiety among stakeholders and jeopardise relationships with them (Kutsch & Hall, 2005). However, the findings extend these findings by showing that the level of risk disclosure can also be affected by IS project managers’ project framing. One project manager argued that when he has a positive project view (low-risk project), risk awareness is present within the project team; a neutral project view (medium-risk project), risk awareness is elevated to the level of the IT leadership team; and a negative project view (high-risk project), more risk awareness is present at the executive level.

Normative prescriptions assume that IS project managers will identify all possible risks that may affect the project (PMI, 2017). However, this study observed that project managers sometimes tend to focus on specific topics, resulting in limiting the range of risks to be considered. According to Smithson’s (1989) taxonomy of ignorance, this type of deliberate ignorance of risk-related information can be called “untopicality”. Prior research found that this deliberate ignorance of risk may be because IS project managers identify risks that are “easy” to process (Kutsch & Hall, 2010). This study extends these findings by showing that IS project managers may use negatively framed attributes in the project frame as the main topics for risk identification. For instance, one project manager argued that if the project budget and timeline are critical attributes (based on stakeholders’ project success factors) and are framed negatively, the risk identification will focus on the risks associated with these two attributes.

Normative studies assume that project managers will compute the extent of expected disutility or impact due to risk using some formula or rules of logic (Moeini & Rivard, 2012; Neumann & Morgenstern, 1974). In assessing the potential impact of a project risk, prior research proposes that a concrete mental construal of a project risk (e.g., a risk is probable) may lead IS project managers to perceive risks as having a greater potential impact compared to an abstract mental construal (e.g., a risk is improbable) (Lee et al., 2019). This study extends these findings by showing that IS project managers may increase the perceived impact of the identified risks when the project is framed as “critical”. Also, project managers may increase the perceived probability and impact of project risks when the project time and budget are tight, and the project outcome materiality is high. Further, negatively framed attributes may lead project managers to increase the perceived impact of risks associated with those attributes; for instance, a project manager reported that if the regulatory and contractual obligations are complicated (i.e., negative attribute frame), this increases the perceived impact of financial risks.

Prior research indicates that enacting adequate risk responses is critical for project success (Barki et al., 2001; Nidhra et al., 2013). When deciding whether to enact a risk response, research suggests that an abstract mental construal of the risk response may lead IS project managers to enact the risk response more than a concrete mental construal (Lee et al., 2019). Researchers also suggest that risk responses are not enacted because IS project managers do not believe they are worth pursuing due to cost and time constraints (Kutsch & Hall, 2009). Further, Moeini and Rivard (2019a) propose that IS project managers' risk response decisions are influenced by perceived risk exposure and risk response attitude. In addition, this study indicates that framing can also influence IS project managers' risk response decisions. For instance, a project manager argued that most project risks are accepted when he has a positive project frame, but early risk mitigation or the transfer of extremely complicated risks is necessary when he has a negative project frame.

#### **5.4 Informing Research on Framing in IS Project Management**

This study contributes to prior research on the role of framing in IS project management, particularly in relation to IS projects. Prior research has shown that framing can affect IT project escalation (Mähring & Keil, 2008), software requirements selection (Fogelström et al., 2009), effort estimation (Jorgensen & Grimstad, 2012), software design creativity (Mohanani et al., 2014), and the decision to continue or abandon a project (Karevold & Teigen, 2010) and investment in new IS projects (Benschop et al., 2022). This study extends these studies by showing that the initial framing of IS projects can also affect project managers' engagement in risk management activities.

This study also contributes to the literature on framing effects, particularly in relation to IS. According to Tversky and Kahneman (1981), the decision-making process includes two phases: an editing phase, in which decision-making information is framed, and a subsequent phase of evaluation. In the editing phase, individuals can either use the frames given by others or develop their own subjective frames. Most framing studies have mainly focused on how people react to externally framed decision information; this approach to framing can be referred to as "imposed framing". A main limitation in studies of framing effects in which frames are created by the experimenters is the inability to describe how decision makers interpret and code decision-making information (Yu et al., 2015). In real-life situations, however, there are typically no codified frames that decision-makers can adopt, and self-comprehension of decision-making information is often the initial step in real-life decision-making (Wang, 2004). Peng et al. (2021) indicated that in order to predict people's behaviour, researchers should first understand how they interpret decision-making information.

Therefore, this study extends the literature on framing effects by taking a different approach to framing called “subjective framing”. Subjective framing describes how decision makers intrinsically interpret and frame decision-making information. In particular, this study expands our knowledge of how the framing of IS projects is developed and how it influences risk management engagement. Mähring and Keil (2008) pointed out that it is critical to demonstrate “how a rationale or framing of the project develops and impacts a project” (p. 262).

The findings of this study reveal that IS project managers interpret project information in the form of attribute framing. In this way, a project frame consists of attributes that are framed positively and negatively; these attributes influence how the project is perceived. Researchers performed a text analysis of the framing used by IS project managers when discussing IS projects (Benschop et al., 2011). However, in their analysis of framing, they used a pre-defined list of words identified from the framing literature. In contrast, this study provides a list of attributes used in IS project managers’ project framing as well as the specific positive and negative words used in the attribute framing. Table 51 shows a comparison between examples of positive and negative words identified in Benschop et al. (2011) and this study.

Table 51. A comparison between positive and negative words identified in Benschop et al. (2011) and this study

<b>Study</b>	<b>Positive framing</b>	<b>Negative framing</b>
Benschop et al. (2011)	X% done; More than X% done; Less than Y% left; Almost X% done; Nearly X% done; X% people satisfied	Y% left; More than Y% left; Less than X% done; Almost Y% left; Nearly Y% left; Y% people dissatisfied
This study’s findings	Budget allocated is suitable; Well-defined business process; Good relationship with the customer; Regulations were not complicated; Scope is clear; Size of the project is small; Known technology; Timeline was relaxed	Very tight budget; Undocumented business processes; Bad [customer] relation; Critically of project is high; Complicated legal, regulatory, and contractual obligations; Vague or undetailed scope; Project size is huge; New technology; Schedule was very tight

Another problem in the previous framing studies in Information Systems is that reference points were given to individuals in a preformatted decision problem, without examining further the use of reference points (e.g., Fogelström et al., 2009; Khan et al., 2010). However, this study offers a hierarchical categorization of reference points that affect the selection of frames, drawing directly from the perspective of IS project managers. For instance, the “relationship with customer” attribute can be evaluated positively as a “good relationship” or negatively as a “bad relationship” based on the previous engagement with the customer (i.e., the reference point), and this reference point is operationalized as the number of management escalations received from the customer.

Furthermore, this study hypothesises how reference points affect attribute frame selection. McKenzie and Nelson (2003) use theory on information leakage to predict that a specific label is more likely to be used to describe a given current situation when its percentage has increased (rather than decreased) relative to a reference point. They found that people tend to describe a 500-ml glass containing 250 ml of water as “half full” (positive frame) when it previously contained 0 ml (i.e., a low reference point) and as “half empty” (negative frame) when it previously contained 500 ml (i.e., a high reference point). Similarly, a task’s progress is more likely to be described by completed work when compared to lower progress values and by remaining work when compared to higher reference values (Karevold & Teigen, 2010).

Therefore, as shown in Figure 6, this study predicts that for an attribute with a quantitative, objective value, a positive frame will be chosen when the reference point (reference point A) is below the attribute value and a negative frame when the reference point (reference point B) is above the attribute value. For example, the “project time” attribute is framed positively as a “relaxed timeline” when the average timeline of past similar projects (i.e., the reference point) is lower than the attribute value and negatively as an “aggressive timeline” when the reference point is higher.

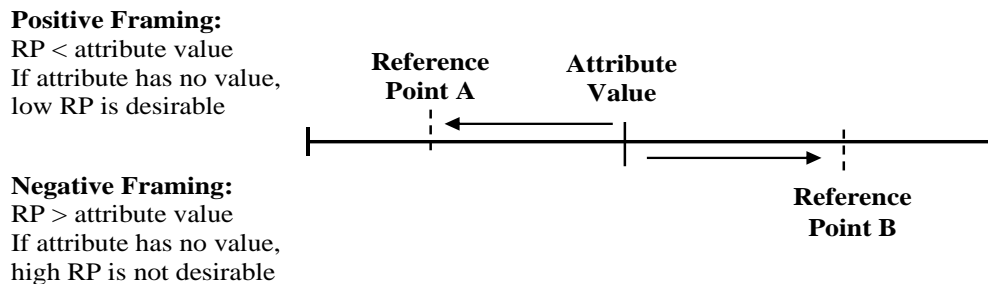


Figure 6. Illustration of how reference points affect attribute frame selection

However, some attributes have no quantitative, objective values against which the reference point can be compared. In this case, this study proposes that when high values of a reference point are desired, a low reference point will lead to negative attribute framing, while a high reference point will lead to positive attribute framing. For example, the “project outcome materiality” attribute can be evaluated based on the expected impact of the project (i.e., the reference point), which can be operationalized as the number of end-users affected by the project. Thus, it is framed as a “mission-critical system” (negative frame) when a large number of end-users are affected by the project. Further, this study proposes that when low values of a reference point are desired, a low reference point will result in positive attribute framing, whereas a high reference point will result

in negative attribute framing. For instance, the “development technology” attribute can be evaluated based on previous project team experience (i.e., the reference point), which can be operationalized as the number of team members who can use the technology. Therefore, it is framed negatively as “new technology” when few team members can use it (i.e., low reference point).

The findings also show that IS project managers communicate their project frames (i.e., the perception a project manager has about a project) by describing the attributes using positive or negative adjectives (i.e., attribute framing). As such, IS project managers use more positive attribute framing than negative attribute framing when they have a positive perception of the project, and vice versa. This finding is in line with previous research that has shown that positive or negative attribute framing may be influenced by people’s opinion of the object in question, such as a project team or an IS project (Benschop et al., 2011, 2022; Sher & McKenzie, 2006).

### 5.5 Contribution to Prospect Theory

Prospect theory and risk-taking models that build on it (e.g., Sitkin & Pablo, 1992; Sitkin & Weingart, 1995) assume that problem framing is unidimensional. As such, a problem can be framed either positively or negatively. For example, in the Asian disease problem (Tversky & Kahneman, 1981), the positive word “saved” is used to describe the outcomes of the proposed options in the “lives-saved frame”: If option A is adopted, 200 people will be saved (+); if option B is adopted, there is a 1/3 probability that 600 people will be saved (+) and a 2/3 probability that no people will be saved (+). On the other hand, the negative word “die” is used in the “lives-lost frame”: If option A is adopted, 400 people will die (-); if option B is adopted, there is a 1/3 probability that nobody will die (-) and a 2/3 probability that 600 people will die (-). As shown in Figure 7(a), frames that can only be either positive or negative are referred to as standard frames and are represented as, respectively, frame (+ + +) and frame (- - -).

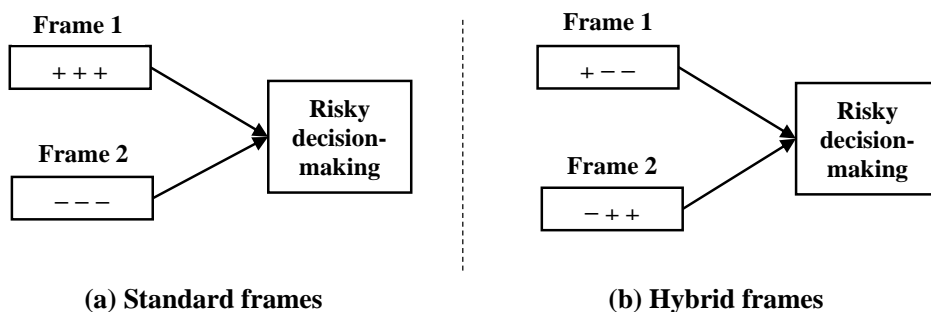


Figure 7. Standard frames versus hybrid frames

In standard framing, a decision problem can be described by different frames, but each frame can only be positive or negative. Nevertheless, by adopting a subjective framing approach, this study's findings indicate that participants used a mix of positive and negative framing to describe their subjective frames. Specifically, they used multiple positively or negatively framed attributes to describe their project frames (i.e., a project manager's perception of a project) (See Appendix I). Hence, a frame that contains both positively and negatively framed information can be referred to as a "hybrid frame".

As demonstrated in Figure 7(b), hybrid frames may be represented as the (- + +) frame or (- - +) frame. For example, the positive frame (lives-saved) of the Asian disease problem can be restructured to be a hybrid frame (- + +) as follows: If option A is adopted, 400 people will die (-); if option B is adopted, there is a 1/3 probability that 600 people will be saved (+) and a 2/3 probability that no people will be saved (+). In this hybrid frame, the first option is framed positively, whereas the second option is framed negatively. In the context of project management, Karevold and Teigen (2010) investigated the effect of framing a troubled project's progress on the decision to continue or abandon it. Two types of frames were created: past-oriented frames ("We have done about 75% of the work", "We have spent about 75% of the budget", and "We have used about 75% of the time") and future-oriented frames ("About 25% of the work remains to be done", "We have about 25% of the budget left", and "We have about 25% of the time left"). Thus, the project progress can be reframed to include past- and future-oriented frames, i.e., a hybrid frame (+ - -), as follows: "We have done about 75% of the work (+), we have about 25% of the budget left (-), and we have about 25% of the time left (-)".

Therefore, it can be expected that the effects of standard frames and hybrid frames on decision-making would vary. In standard attribute framing, the effect of a single attribute framed either positively or negatively on the evaluation of an object is measured. In cases where a problem is framed with a combination of positive and negative attribute frames (i.e., hybrid framing), the findings of this study indicate that the decision makers may combine the positively and negatively framed attributes into a unified frame that may be positive or negative. Consequently, their decision-making could be influenced by the overall frame, a single framed attribute, and/or a group of framed attributes.

Prospect theory and the framing studies that build on it view framing as a static phenomenon, focusing on the impact of framing on one-time decisions. This study demonstrates, however, that framing is a dynamic phenomenon that can change over time, thereby influencing the choices of the decision-maker. Specifically, this study shows that the IS project manager's initial framing of the project and, consequently, their engagement in risk management may change over the project's life cycle. The project framing may change throughout the project life cycle as a result of critical events such as a change in management or business direction, the departure of a

member(s) of the project team with expertise in such projects, a change in project scope, a change in target timelines, an increase or decrease in project outcomes, and the introduction of new legal and regulatory requirements. For instance, if the project outcomes increase or change, such as adding health and safety requirements to a visitor tracking system, the whole risk management process should be revisited because new risks need to be identified and existing risks need to be assessed. Thus, a subjective framing approach is more appropriate than an imposed framing approach for explaining dynamic decision-making, which is characterised by multiple, interdependent, real-time decisions occurring in an environment that changes independently (Gonzalez et al., 2003). The comparison between standard, imposed framing and subjective, hybrid framing is presented in Table 52.

Table 52. Comparison between standard, imposed framing and subjective, hybrid framing

<b>Framing approach</b>	<b>Frame type</b>	<b>Reference point usage</b>	<b>Framing effect</b>
<b>Standard, imposed framing</b>	A single frame can only be positive or negative.	There is only one reference point used to frame the decision information.	<ul style="list-style-type: none"> <li>• View framing as a static phenomenon.</li> <li>• It is usually used to explain the effect of framing on one-time decisions.</li> </ul>
<b>Subjective, hybrid framing</b>	A single frame can include both positively and negatively framed decision information.	Multiple reference points are used to frame the decision information.	<ul style="list-style-type: none"> <li>• View framing as a dynamic phenomenon.</li> <li>• It emphasises that framing can change over time and alter the decision maker's choices.</li> <li>• It can explain the effect of framing on multiple, interdependent, real-time decisions.</li> </ul>

Prospect theory predicts that individuals are risk-averse when the decision problem is framed positively and risk-seeking when it is framed negatively. The results of this study, however, contradict the predictions of prospect theory, as they indicate that IS project managers are risk-seeking under positive project framing and risk-averse under negative project framing. One explanation of why preference reversal occurs is the consideration of the task goal (McElroy & Seta, 2007). For example, in the Asian disease problem (Tversky & Kahneman, 1981), the goal is to increase the decision outcome (i.e., human lives). Consequently, whether the problem is framed positively or negatively, the goal of increasing lives is desirable to decision makers. This explains why they prefer the safe option (i.e., they are risk-averse) when the lives saved are emphasised in the positive frame, but they prefer the risky option (i.e., they are risk-seeking) when the deaths are emphasised in the negative frame.

Yet, not all tasks are aimed at increasing the outcome in questions; in other cases, the goal is to decrease it (McElroy & Seta, 2007). In our case, the application of risk management requires

time, effort, and other resources. However, it is difficult to justify the costs associated with risk management because its benefits cannot be quantified in advance. Regarding the decision to engage in risk management, the inherent goal is to justify the costs of carrying out risk management activities (Kutsch & Hall, 2009). Therefore, under a positive project framing, IS project managers perceive low project risks and tend to reduce the costs of risk management because it is deemed unnecessary; the investment of resources into risk management cannot be justified. Conversely, under a negative project framing, IS project managers perceive high project risks and tend to increase the resources invested in risk management. In this situation, the benefits of risk management can be demonstrated, and its costs justified. In a case such as this, prospect theory would not predict project managers to be risk-averse when the problem is framed positively and risk-seeking when it is framed negatively. Rather, because decreasing the decision outcome (i.e., costs of risk management) is desirable, a preference reversal would be expected; IS project managers are risk-seeking (not risk-averse) when the problem is framed positively and risk-averse (not risk-seeking) when it is framed negatively.

## **5.6 Implications for Practice**

This study has implications for various IS project management audiences. First, prior research indicates that software project failures occur, in part, because IS project managers often fail to manage project risks that can and often do materialise adequately (Keil & Lee, 2019). According to the study's findings, project failures could instead be caused by project frames being subjectively developed by IS project managers. The findings reveal that subjective project frames may cause IS project managers to form an unrealistically optimistic perception of the project and to underestimate its associated risks. For instance, in one of the projects mentioned by a participant, the project manager disengaged from risk management practices because the project was framed as simple and easy; this was due to the fact that the project deliverables were straightforward and the project's impact on the business was not significant. However, many risks that could have been identified at the outset materialised, resulting in the delay of the project's delivery. Therefore, the findings should motivate IS project managers to reflect on what influences and biases their views (or frames) of projects, as self-awareness may help in developing better frames and, in turn, better subsequent actions in projects. So, it is suggested that IS project managers develop a checklist to surface the beliefs and assumptions that influence their project framing (Nesbit, 2007).

Second, project governing entities (e.g., steering committees) should be aware that the information received from IS project managers is not entirely objective but is framed by them, and a biased view of the project can be developed as a result. Thus, governing entities might be influenced by such framing without even being aware of it. For example, prior research reveals that the initial framing of IS projects may bias decision-makers towards investing in new projects

(Benschop et al., 2022). Furthermore, governing entities should be aware that the project managers' project framing is an indication of their perceived risk of the project. Thus, the positive framing of a project indicates low project risks, whereas the negative framing indicates high project risks. So, governing entities should obtain information from other sources to validate or test the project manager's perception of a project and its level of risk. As a result, if the project manager has an unrealistic and/or optimistic view of the project and its risks, this could be discovered prior to making poor decisions.

Finally, the findings can be utilised by professional associations that provide project management training materials (e.g., the PMI). Such training materials (e.g., PMBOK by PMI) acknowledge that, as each project is unique, the application of risk management processes should be tailored (PMI, 2017). The findings reveal a set of attributes influencing IS project managers' view of a project and their engagement in risk management (e.g., project criticality, organisation maturity, and project outcome materiality). Therefore, these attributes can be incorporated into these training materials as considerations for tailoring the risk management processes. Furthermore, research evidence indicates that many IS project managers, although trained with such formal training materials, do not always follow them. For example, these formal materials assume that IS project managers will follow prescribed risk management practices (PMI, 2017); however, this is far from the observations showing that they frequently disengage from formal practices (Kutsch et al., 2013). The PMI (2019) indicates that 27% of surveyed organisations reported that they do not "always" use risk management practices. Therefore, there is a gap between formal prescriptions of risk management (e.g., PMBOK Guide) and practice. As long as this gap exists, the acceptance of formal risk management prescriptions is at stake. This study underlines the importance of examining the project framing of IS project managers in order to gain a better understanding of their behaviour and decision-making in managing risks. Project framing encompasses the rationale or argument for the actions and behaviours of IS project managers (Mähring & Keil, 2008). For instance, it is revealed that some IS project managers do not apply risk management practices when the relationship with the customer is good or the experience level of the project team is high. Therefore, this study opens the opportunity for the development of more reliable formal prescriptions based on assumptions about practice, thereby enhancing their acceptability.

## **5.7 Limitations and Future Research**

As with any research, this study has limitations, and it is appropriate to discuss these in conjunction with future research recommendations. First, the main limitation of this study is that the research sample was restricted. As a result, one criticism of this study could be its limited ability to generalise its conclusions. However, generalizability was not the intended goal of this study; rather, this study addressed the issue of transferability through the use of a thick description

(Creswell, 2018). Transferability concerns the extent to which a study's findings can be applied to other situations or contexts (Merriam & Tisdell, 2015). Thus, the researcher suggests conducting similar studies with larger sample sizes and greater variation in participant characteristics (e.g., position, years of experience, and education). This would be fruitful in increasing the possibility of a greater range of applications by readers or users of the study (Merriam & Tisdell, 2015).

Second, this study focused on software projects. Therefore, the extent to which the findings are generally applicable to other project types (including other IS projects), such as infrastructure projects, global software development (GSD) projects, and engineering or construction projects, is debatable. Therefore, future studies could further explore how the framing of other IS project types, such as infrastructure projects, develops and impacts the project. This would be useful in either providing further evidence for the robustness of the effect of project framing or identifying the differences in framing across different contexts.

Third, this study mainly focused on attribute framing; however, other types of framing (Levin et al., 1998), such as risky choice framing and goal framing, exist but were not explored in this study. To establish a more comprehensive view of the development and effect of subjective framing in IS projects, future studies could further explore other framing types in addition to attribute framing. Furthermore, it would be beneficial to explore the relationship between these types of framing and the differences in their effect on decision-making in IS projects.

Fourth, this study has assumed that the project manager is the main risk actor. However, risk management literature indicates that various stakeholders, such as the business analyst, quality assurance manager, and test manager, may be directly or indirectly involved in the risk management process (Schmidt et al., 2001). Therefore, risk management is sometimes viewed as a collective-level activity (Moeini & Rivard, 2019b); thus, future research at that level would be fruitful.

In addition to proposing further research that addresses the limitations of this study, this study also opens other avenues for future study. First, most framing studies have focused on the impact of framing on receivers of framed information (i.e., imposed framing). The main limitation of these studies is their inability to describe how decision makers interpret and code decision-making information (Yu et al., 2015). According to Peng et al. (2021), in order to predict people's behaviour, researchers need to understand how they interpret decision-making information. Thus, more research is required to investigate how decision makers intrinsically frame decision-making information (i.e., subjective framing) in the context of IS project management.

Second, while this study focused on the framing of IS projects at a point in time, particularly at the beginning of the projects, it could be extended by looking at how framing changes over the

project life cycle and, in turn, influences risk management engagement. It would be particularly interesting to determine how the changes in framing influence engagement in risk management and what the reasons for these changes could be. Thus, it could be fruitful to conduct case studies in which framing is longitudinally analysed to identify how and why it changes by, for example, relating it to critical events.

Third, previous framing studies adopted the standard framing, in which a decision problem can only be framed positively or negatively (Tversky & Kahneman, 1981). However, this study's findings reveal the existence of hybrid framing (i.e., frames that contain both positively and negatively framed information). Thus, it can be expected that the effects of standard and hybrid frames on decision-making will vary. Future studies could further investigate the framing effects caused by hybrid frames.

## **5.8 Chapter Summary**

This chapter provided a detailed discussion of the study findings. This included a summary of the key findings, the theoretical and practical contributions of this research, its limitations and suggestions for future research. This study examined how IS project managers subjectively interpret project information (i.e., project framing) and how this influences their engagement in risk management. A total of 26 semi-structured interviews were conducted with project managers in various IT/IS companies in New Zealand. The interview data were analysed using the template analysis style of thematic analysis. The framing of a project is developed using attribute framing. It involves two types of attributes: objective attributes that are directly associated with objective facts about a project (e.g., project budget) and subjective attributes that are based on the personal judgement of IS project managers (e.g., project criticality). These attributes are assessed using different reference points, which arise from either project managers' past experience or information acquired during the development of the project framing. The project framing influences engagement in risk management through the project frame, a single framed attribute, and/or a group of framed attributes. Risk management engagement includes several dimensions: technical intensity, such as funding and time investment; perceived intensity, such as discipline level and adherence to process; and process-related activities, such as risk impact and probability and risk identification topics.

This study makes several theoretical contributions. First, for behavioural IS project risk management research, it explains how project managers' subjective framing of IS projects influences their engagement in risk management and provides a broader definition of risk management engagement than that used in this literature. Second, it informs research on framing in IS project management by demonstrating how decision makers, in real-life situations, subjectively frame decision-making information; specifically, it demonstrates how IS project

managers frame project information, including the influential attributes and reference points that assist them in project framing. Third, it contributes to prospect theory by denying the unidimensionality of problem framing, accounting for hybrid framing, and viewing framing as a dynamic phenomenon. To practitioners, the study motivates IS project managers to reflect on what influences and biases their views (or frames) of projects for better subsequent actions and provides new recommendations that can be incorporated into the project management training materials, such as the PMBOK guide.

The study has some limitations, but it also opens up new avenues for future research. The sample size was restricted, suggesting that future research could employ larger, more diverse samples to enhance the potential for a wider range of applications by readers or users of the study. The emphasis on IS projects limits the applicability of the findings to other contexts, recommending a further investigation of project framing in other domains, such as engineering and construction. This study focused on attribute framing; future studies could further explore other types of framing, such as risky choice framing and goal framing. While this study focused on the project manager as the main risk actor, future research could examine risk management as a collective activity involving multiple stakeholders. Lastly, future research could investigate how framing evolves throughout the lifecycle of a project and how standard and hybrid frames influence decision-making differently.

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## **Appendices**

### **Appendix A Final Interview Guide**

#### **Overview:**

- How much funding is needed to perform risk management activities?
- How much time is allocated for risk management activities?
- What people are involved in each risk management activity?
- What tools and techniques do you use in each risk management activity?

#### **Topic 1: Project Perception Development**

- How do you build a perception or view of a software project?
- What attributes influence your project perception?
- How do you evaluate the attributes influencing your project perception?
- Do you combine the evaluations of these attributes to create an overall view of the project?

#### **Topic 2: Project Perception Description**

- Please provide an example of a project for which you had a positive view at the outset.
- Please provide an example of a project for which you had a negative view at the outset.

#### **Topic 3: Effect of Project Perception on Risk Management**

- How does your project perception or view influence your engagement in risk management?
- What risk management dimensions are affected by your project perception?

#### **Topic 4: Project Perception Change**

- Does the initial project perception change over the project lifecycle?
- How and why does the initial perception of a project change?
- How does the change in project perception influence engagement in risk management?



### Participant Information Sheet

**Date Information Sheet Produced:**

08/07/2021

**Project Title**

Engagement in risk management practices in software development projects: Framing effects.

**An Invitation**

I am Mr Abdelghany Salah Abdelghany Mosa, currently a PhD candidate at Auckland University of Technology in the Department of Business Information systems. I would like to invite you to participate in my research on how project managers' subjective framing of project information influences their decision to engage or disengage with risk management. Your participation is voluntary, and you may withdraw at any time prior to the completion of data collection.

**What is the purpose of this research?**

Failure has been prominent in many software projects over the last four decades. Much of these failures have been attributed to poor risk management. To overcome these failures, risk management researchers have focused on developing formal prescriptions to guide project managers on how they should manage risks. These prescriptions take the form of risk checklists, practices and risk response strategies. However, project managers in practice do not always follow the formal prescriptions of risk management. So, the purpose of this study is to understand how project managers actually manage risks and why they sometimes do so differently from formal prescriptions. Consequently, your valued contribution in this research will contribute to advancing the experiential knowledge which is created and held by project managers in their day-to-day experiences, ensuing from how risks are actually managed. The findings of this research may be used for academic publications, mainly in the information systems discipline.

**How was I identified and why am I being invited to participate in this research?**

You have been identified as a potential participant through LinkedIn, an online business directory (e.g., [Katalyst Business](#)) or because you have been referred by another participant who thought that you would be interested in participating in the study. You have been invited to participate in this study because you are a project manager currently working in the IT and telecommunications industry and have a least two years of work experience in managing software projects.

**How do I agree to participate in this research?**

You agree to participate by signing the consent form. The consent form and data will be confidential and viewed by the researcher only. Your participation in this research is voluntary (it is your choice) and whether or not you choose to participate will neither advantage nor disadvantage you. You can withdraw from the study at any time. If you choose to withdraw from the study, you will be offered the choice to have any data that is identifiable as belonging to you removed, or allow it to continue to be used. However, once the findings have been produced, removal of your data may not be possible.

**What will happen in this research?**

You will be asked questions in an interview that will take approximately one hour of your time. The interview will take place somewhere outside your workplace, for example in a café. You will be asked about your project risk management approach and experiences, which project attributes influence/ influenced your decisions, and how these attributes do/did so (*please refer to the interview questions attached at the end of this information sheet*).

Once your interview is over, you will be asked to invite other potential participants whom you feel may be interested in participating in this research to contact the researcher if they are keen to take part. You have the right to refuse to do so.

**What are the discomforts and risks?**

I do not anticipate any major ethical risks or discomforts due to the voluntary nature of the participation. The interview questions ask about your own experience in risk management. You have the right not to answer an

questions if you prefer not to do so. I will not share participant information and interview responses with anyone else. Therefore, the main concern associated with this participation is to protect your privacy and information from unauthorized access and use.

**How will these discomforts and risks be alleviated?**

If you experience discomfort with the way I ask you the question or the question itself, you can simply let me know and I will either rephrase the question or stop asking the question. You can also withdraw from the interview at any point. Your personal information (i.e., name, workplace affiliation, email) will be anonymised before the data analysis starts. Additionally, this information will be encrypted and stored separately from the data.

**What are the benefits?**

The immediate benefit for participants will be their opportunity to reflect on prior risk management experiences. Project managers can understand how their project frames affected their decisions and the different cognitive biases leading to systematic errors in decisions. The outcome of this study will help develop guidelines to increase project managers' self-awareness on how they use their intuition with reduced biases. Consequently, these guidelines could be incorporated into the project management training material. Ultimately, this will help organizations to improve the practice of project risk management. The benefit of this project for the researcher is to gain a PhD Degree.

**How will my privacy be protected?**

To protect your privacy, paper-based data will be kept in a locked cabinet on AUT premises. Digital data, such as audio recordings, will be stored on AUT network drives with restricted folder permissions. Only I and my supervisors will have access to the data. Your personal information will not be revealed in research reports or publications. The Auckland University of Technology policy mandates the preservation of research data and records for a minimum of six years. If you decide to withdraw from the research, all data relating to you will be destroyed."

**What are the costs of participating in this research?**

There are no costs to you for participating in this study except for approximately one hour of your time for answering interview questions, which is much appreciated.

**What opportunity do I have to consider this invitation?**

You will be given at least three weeks to review this information sheet and either accept or decline this invitation to participate in this research. If you want to seek further information, to clarify any points you can contact us from the contact details below.

**Will I receive feedback on the results of this research?**

Yes, you will receive copies of the interview transcript to review the accuracy of the interview and amend, if necessary. You can choose to receive a summary of the findings of this project by letting us know in the consent form.

**What do I do if I have concerns about this research?**

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, Associate Professor Harminder Singh, [singh@aut.ac.nz](mailto:singh@aut.ac.nz), (+649) 921 9999 ext 5029.

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTEK, [ethics@aut.ac.nz](mailto:ethics@aut.ac.nz), (+649) 921 9999 ext 6038.

**Whom do I contact for further information about this research?**

Please keep this Information Sheet and a copy of the Consent Form for your future reference. You are also able to contact the research team as follows:

**Researcher Contact Details:**

Primary Researcher: Abdelghany Mosa, [em12896@aut.ac.nz](mailto:em12896@aut.ac.nz), +64210553828

**Project Supervisor Contact Details:**

Primary Supervisor: Associate Professor Harminder Singh, [singh@aut.ac.nz](mailto:singh@aut.ac.nz), (+649) 921 9999 ext 5029

Secondary Supervisor: Dr Farkhondeh Hassandoust, [ferry@aut.ac.nz](mailto:ferry@aut.ac.nz), (+649) 921 9999 ext 5419

Approved by the Auckland University of Technology Ethics Committee on *type the date final ethics approval was granted*, AUTEK Reference number *type the reference number*.

## Appendix C Participant Consent Form



### Consent Form

**Project title: *Engagement in risk management practices in software development projects: Framing effects.***

**Project Supervisor: *Associate Professor Harminder Singh and Dr Farkhondeh Hassandoust***

**Researcher: *Mr Abdelghany Salah Abdelghany Mosa***

- I have read and understood the information provided about this research project in the Information Sheet dated dd mmmm yyyy.
- I have had an opportunity to ask questions and to have them answered.
- I understand that notes will be taken during the interviews and that they will also be audio-taped and transcribed.
- I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time without being disadvantaged in any way.
- I understand that if I withdraw from the study then I will be offered the choice between having any data that is identifiable as belonging to me removed or allowing it to continue to be used. However, once the findings have been produced, removal of my data may not be possible.
- I agree to take part in this research.
- I wish to receive a summary of the research findings (please tick one): Yes  No

Participant's signature: .....

Participant's name: .....

Participant's Contact Details (if appropriate):

.....  
.....  
.....  
.....

Date:

**Approved by the Auckland University of Technology Ethics Committee on *type the date on which the final approval was granted* AUTEK Reference number *type the AUTEK reference number***

*Note: The Participant should retain a copy of this form.*

## Appendix D Example of Interview Notes

*Interview notes were used during the interview session to help the researcher organise the interview, conduct a preliminary analysis, and obtain participant feedback on the veracity of the findings and interpretations.*

### Interview notes: (Albert)

<b>Attributes affecting project perception/RM</b>	<b>How they are evaluated or measured?</b>	<b>RM dimensions affected?</b>
Business benefits/objectives	<ul style="list-style-type: none"> <li>- By reviewing the business case document (highlight key success factors of the project from the business case which were mentioned by the project stakeholders)</li> </ul>	<ul style="list-style-type: none"> <li>- Main focus is on the risks related to the attributes that are important based on the initial assessment of the business case/statement of work or had a negative effect on project success factors.</li> </ul>
Impact of project outcome on business	<ul style="list-style-type: none"> <li>- Mission critical / Business important / normal operational system</li> <li>- Project for building a website for NZ Museum / School</li> <li>- Project for building a website for Bank / Government department</li> <li>- Evaluation based on:               <ul style="list-style-type: none"> <li>- Availability of the solution</li> <li>- Safety concerns (impacting a large number of end users)</li> <li>- No alternative to the system (e.g., manual system)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- Importance of risk management (how serious is this practice &amp; accountability &amp; responsibility of owning risks)</li> <li>- Details/quality of risk management</li> </ul>
Budget	<ul style="list-style-type: none"> <li>- Tight / suitable, under budget / over budget</li> <li>- Budget allocated (written in the business case) compared to:               <ul style="list-style-type: none"> <li>- Scope to be delivered (size &amp; complexity)</li> <li>- PM experience in similar projects</li> <li>- Expert judgement</li> </ul> </li> </ul>	
Schedule	<ul style="list-style-type: none"> <li>- Tight schedule / relaxed schedule</li> <li>- Schedule allocated (written in the business case) compared to:               <ul style="list-style-type: none"> <li>- Scope to be delivered</li> <li>- Number of allocated resources</li> <li>- PM experience in similar projects</li> <li>- Expert judgement</li> </ul> </li> </ul>	
Complexity of solution delivery	<ul style="list-style-type: none"> <li>-Low / Medium / High</li> <li>-Expert judgement</li> <li>-PM experience in similar projects</li> </ul>	
Scope	<ul style="list-style-type: none"> <li>- Well defined &amp; detailed / vague scope</li> <li>- Reviewing business case</li> <li>- Reviewing statement of work               <ul style="list-style-type: none"> <li>- level of details relevant to the project size (budget)</li> </ul> </li> <li>- Acceptance criteria existed or not?</li> <li>- PM experience in similar projects (scope)</li> </ul>	

<p>Does the evaluation of these attributes give you an overall perception of the project?</p>	<p>- Overall risk assessment / RM complexity (High, medium, low)</p>	<p>- Perceived resources for RM (budget, time, people) for RM</p> <p>- <b>Low project risk:</b> Budget (&lt;5%), Time (1%), People (PM + core team in initial assessment)</p> <p>- <b>Medium project risk:</b> Budget (10%), Time (3% - 5%), People (PM - core team, frequent risk review with specific team how own the risk)</p> <p>- <b>High project risk:</b> Budget (&gt;=20%), Time (10%), People (core team in all the RM activities and risk reviews)</p>
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	Identify risks	Analyse risks	Plan responses	Implement responses	Monitor risks
<b>Funding</b>	15%-20% of the overall project budget				
<b>People</b>	PM, Business analyst, technical team, solution architect, test managers	PM, Business analyst, technical team, solution architect, test managers	PM, Business analyst, technical team, solution architect, test managers	PM, risk owners	PM
<b>Time</b>	1%-10% of overall project time				
<b>Tools/Techniques</b>	Brainstorming session, mind map (tool)	Excel sheet, probability/impact matrix, risk exposure	Response strategies (avoid, hold, transfer, mitigate), Excel sheet (from analysis)	Case by case	Risk review meeting, Excel sheet (risk register)

## Appendix E Sample of Coding of Interview Data

Prospect Theory's Concepts	Definitions of Concepts Within the Study's Context	Example Quote	Explanation
<i>Reference Points:</i> The comparative standards against which other objects are evaluated or measured.	Statements that compare or evaluate an attribute to some criteria to determine the level of effort involved in managing it and/or the associated level of unknown or risk.	<i>"Is it an aggressive timeline or pretty much relaxed? This is identified from the when I compare the project timelines to the average time to market or average timelines for similar projects."</i>	The project time attribute is evaluated based on the average timeline of previous similar projects (i.e., the reference point).
<i>Attributes Framing:</i> The evaluation of an object based on its attributes.	Statements that describe attributes of a project in either positive or negative terms.	<i>"Budget allocated is really suitable."</i>	The positive adjective "suitable" is used to frame the budget attribute.
<i>Project Frame:</i> The perception that an IS project manager has about a project.	Statements that conveyed an overall judgement or perception of the project without referencing any attributes.	<i>"If I am about to run a low-risk project."</i>	The phrase "low-risk project" refers to the project's overall perception, that is, the overall perceived risk associated with the project.
<i>Framing Effects:</i> Different frames of a choice problem affect individuals' actions and behaviours.	<i>Project Frame Effect:</i> Statements that relate project managers' actions in risk management to a specific project frame.	<i>"In the very lightest touch projects, you know, we might try and spend very little on risk management, you know, 1% 5%."</i>	The project managers' risk management action "...spend very little on risk management..." relates to the project frame "very lightest touch projects".
	<i>Single Attribute Effect:</i> Statements that relate project managers' actions in risk management to a specific framed attribute.	<i>"If you just have a very tight budget, you just go into the basics of risk management and determine the clear ones [risks] to the project."</i>	The project managers' risk management action "...just go into the basics of risk management..." relates to the budget attribute that is framed negatively.
	<i>Group of Attributes Effect:</i> Statements that relate project managers' actions in risk management to a group of framed attributes.	<i>"If we think of a software project that has tightened time and tightened budget, it is not expected that you do that risk assessment more than once at the beginning of the project."</i>	The project managers' risk management action "...you do that risk assessment more than once..." relates to the attributes of budget and time that are framed negatively.

## Appendix F Final Coding Template

1 Project Framing
1.1 Project Framing Development
1.2 Project Framing Description
1.3 Types of Project Frames
1.3.1 Negative, high-risk
1.3.2 Positive, low-risk
1.3.3 Neutral, medium-risk
1.4 Project Framing Change
2 Attribute Framing
2.1 Attributes
2.1.1 Objective attributes
2.1.1.1 Project objectives & drivers
2.1.1.2 Project domain
2.1.1.3 Complexity of business processes
2.1.1.4 Regulatory & contractual obligations
2.1.1.5 Documentation quality of existing solution
2.1.1.6 Organisation maturity
2.1.1.7 Customer category
2.1.1.8 Project budget
2.1.1.9 Project size
2.1.1.10 Project scope
2.1.1.11 Stakeholders appetite
2.1.1.12 Team skills & experiences
2.1.1.13 Development technology
2.1.1.14 Project time
2.1.2 Subjective attributes
2.1.2.1 Project complexity
2.1.2.2 Project criticality
2.1.2.3 Project financial importance
2.1.2.4 Project outcome materiality
2.1.2.5 Relationship with customer
2.2 Types of Attribute Frames
2.2.1 Negative
2.2.2 Positive
3 Reference Points
3.1 Reference Source
3.1.1 Internal references

3.1.2 External references
3.2 Reference Type
3.2.1 Historical references
3.2.1.1 Previous similar projects
3.2.1.1.1 Previous evaluations of attributes
3.2.1.1.2 Similar projects frequency
3.2.1.2 Previous project team experience
3.2.1.3 Previous experience with customers
3.2.2 Project attribute references
3.2.2.1 Estimated/allocated budget
3.2.2.2 Estimated/allocated time
3.2.2.3 Estimated effort
3.2.2.4 Expected revenue
3.2.2.5 Development technology
3.2.2.6 Project team size
3.2.2.7 Project size
3.2.3 Organisational & environmental references
3.2.3.1 Expected impact of project
3.2.3.1.1 on end-users/customers
3.2.3.1.2 on revenues
3.2.3.1.3 on business units/areas
3.2.3.2 Resources availability in market
3.2.3.3 Company's current financial situation
3.2.3.4 Project-generated system alternatives
3.2.3.5 Regulatory fines
3.2.4 Technical references
3.2.4.1 Required skill set
3.2.4.2 Complexity of features list
3.2.4.3 Number of deployment locations
3.2.4.4 Integration intensity with existing systems
3.2.4.5 Expected simultaneous transactions volume
3.2.5 Expert judgement references
4 Project Framing Effect
4.1 Project Frame Effect
4.2 Single Attribute Effect
4.3 Group of Attributes Effect
5 Risk Management Dimensions
5.1 Technical Intensity

5.1.1 Funding
5.1.2 Time investment
5.1.3 Human resources involvement
5.1.4 Tools & techniques usage
5.1.5 Risk reviews frequency
5.2 Perceived Intensity
5.2.1 Discipline level
5.2.2 Details & documentation
5.2.3 Adherence to process
5.2.4 Risk management approach
5.3 Process-Related Activities
5.3.1 Risks impact/probability
5.3.2 Risk identification topics
5.3.3 Risk disclosure
5.3.4 Risk response strategies
6 Other
6.1 Goal framing
6.2 Risk perception
6.3 Project framing & optimism
6.4 Importance/Weights of attributes
6.5 Resources for risk management

## Appendix G Ethics Application Approval



AUT

TE WĀNANGA ARONUI  
O TĀMAKI MAKĀU RAU

### Auckland University of Technology Ethics Committee (AUTEC)

Auckland University of Technology  
D-88, Private Bag 92006, Auckland 1142, NZ  
T: +64 9 921 9999 ext. 8316  
E: [ethics@aut.ac.nz](mailto:ethics@aut.ac.nz)  
[www.aut.ac.nz/researchethics](http://www.aut.ac.nz/researchethics)

9 July 2021

Harminder Singh  
Faculty of Business Economics and Law

Dear Harminder

Re Ethics Application: **21/169 Engagement in risk management practices in software development projects: Framing effects**

Thank you for providing evidence as requested, which satisfies the points raised by the Auckland University of Technology Ethics Committee (AUTEC).

Your ethics application has been approved for three years until 9 July 2024.

#### Standard Conditions of Approval

1. The research is to be undertaken in accordance with the [Auckland University of Technology Code of Conduct for Research](#) and as approved by AUTEC in this application.
2. A progress report is due annually on the anniversary of the approval date, using the EA2 form.
3. A final report is due at the expiration of the approval period, or, upon completion of project, using the EA3 form.
4. Any amendments to the project must be approved by AUTEC prior to being implemented. Amendments can be requested using the EA2 form.
5. Any serious or unexpected adverse events must be reported to AUTEC Secretariat as a matter of priority.
6. Any unforeseen events that might affect continued ethical acceptability of the project should also be reported to the AUTEC Secretariat as a matter of priority.
7. It is your responsibility to ensure that the spelling and grammar of documents being provided to participants or external organisations is of a high standard and that all the dates on the documents are updated.

AUTEC grants ethical approval only. You are responsible for obtaining management approval for access for your research from any institution or organisation at which your research is being conducted and you need to meet all ethical, legal, public health, and locality obligations or requirements for the jurisdictions in which the research is being undertaken.

Please quote the application number and title on all future correspondence related to this project.

For any enquiries please contact [ethics@aut.ac.nz](mailto:ethics@aut.ac.nz). The forms mentioned above are available online through <http://www.aut.ac.nz/research/researchethics>

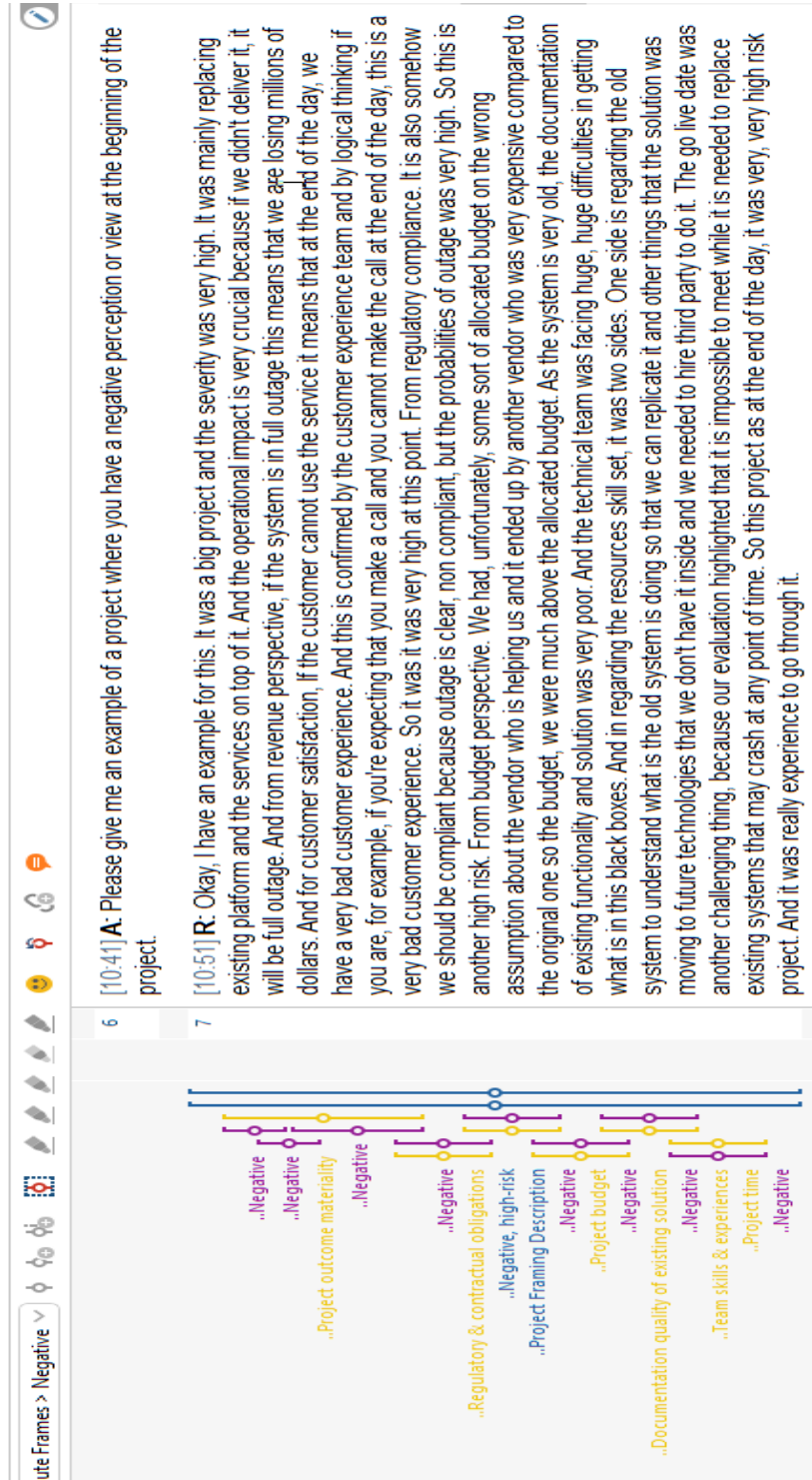
(This is a computer-generated letter for which no signature is required)

The AUTEC Secretariat  
**Auckland University of Technology Ethics Committee**

Cc: [em12896@aut.ac.nz](mailto:em12896@aut.ac.nz); Farkhondeh Hassandoust

## Appendix H Example of a project with a negative view

ute Frames > Negative



6 [10:41] A: Please give me an example of a project where you have a negative perception or view at the beginning of the project.

7 [10:51] R: Okay, I have an example for this. It was a big project and the severity was very high. It was mainly replacing existing platform and the services on top of it. And the operational impact is very crucial because if we didn't deliver it, it will be full outage. And from revenue perspective, if the system is in full outage this means that we are losing millions of dollars. And for customer satisfaction, if the customer cannot use the service it means that at the end of the day, we have a very bad customer experience. And this is confirmed by the customer experience team and by logical thinking if you are, for example, if you're expecting that you make a call and you cannot make the call at the end of the day, this is a very bad customer experience. So it was it was very high at this point. From regulatory compliance. It is also somehow we should be compliant because outage is clear, non compliant, but the probabilities of outage was very high. So this is another high risk. From budget perspective. We had, unfortunately, some sort of allocated budget on the wrong assumption about the vendor who is helping us and it ended up by another vendor who was very expensive compared to the original one so the budget, we were much above the allocated budget. As the system is very old, the documentation of existing functionality and solution was very poor. And the technical team was facing huge, huge difficulties in getting what is in this black boxes. And in regarding the resources skill set, it was two sides. One side is regarding the old system to understand what is the old system is doing so that we can replicate it and other things that the solution was moving to future technologies that we don't have it inside and we needed to hire third party to do it. The go live date was another challenging thing, because our evaluation highlighted that it is impossible to meet while it is needed to replace existing systems that may crash at any point of time. So this project as at the end of the day, it was very, very high risk project. And it was really experience to go through it.

..Negative  
..Negative  
..Project outcome materiality  
..Negative  
..Negative  
..Regulatory & contractual obligations  
..Negative, high-risk  
..Project Framing Description  
..Negative  
..Project budget  
..Negative  
..Documentation quality of existing solution  
..Team skills & experiences  
..Project time  
..Negative

## Appendix I Code Relations Browser

The relationships between codes are represented visually through the Code Relations Browser. The symbols at each node show how many segments were simultaneously coded with the row code and the column code.

