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École affiliée à l'Université de Montréal

A Behavioral Perspective on IT Project Risk Management: A Three-essay Thesis

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Thèse présentée en vue de l'obtention du grade de Ph. D. en administration
(option Technologies de l'information)

Septembre 2015

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Cette thèse intitulée :

A Behavioral Perspective on IT Project Risk Management: A Three-essay Thesis

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Résumé

Cette thèse adopte une perspective comportementale pour étudier la gestion de risque de projet dans le domaine des technologies d'information (TI). Elle est motivée par des résultats d'études qui suggèrent que l'exposition au risque perçue par les chefs de projets (i.e., leur évaluation subjective des menaces pesant sur les objectifs d'un projet) et leurs décisions relatives à l'adoption de réponses au risque (i.e., d'entreprendre des actions en vue de réduire l'exposition au risque) diffèrent parfois des prescriptions de la littérature. Postulant qu'une meilleure compréhension du comportement de gestion de risque des chefs de projet TI peut aider à développer des pratiques mieux adaptées à leurs besoins, cette thèse comprend trois essais portant sur des aspects particuliers de cette problématique.

Le premier essai utilise une méthode de problématisation pour recenser la littérature sur la gestion de risque de projet TI. Plus particulièrement, on s'intéresse aux hypothèses fondamentales de la littérature de nature normative. À celles-ci, l'essai oppose des hypothèses fondamentales alternatives, de nature comportementale et offre plusieurs pistes de recherche.

Le deuxième essai – une étude qualitative – porte sur deux types de processus d'évaluation de l'exposition au risque les processus analytiques et les processus expérientiels. Prenant appui sur des entretiens en profondeur avec des chefs de projet TI, l'essai offre des propositions portant sur les antécédents de la préférence des chefs de projet pour l'une ou l'autre approche et met particulièrement en lumière deux processus expérientiels, l'utilisation d'heuristiques et l'appel à l'intuition fondée sur l'expertise.

Le troisième essai – une enquête –développe un modèle des antécédents de l'intention des chefs de projet TI à adopter certaines réponses spécifiques au risque. Il instancie le modèle pour trois réponses spécifiques, enrichit chaque instance avec les croyances saillantes d'un échantillon de chefs de projets TI, et teste chaque instance à l'aide d'un échantillon distinct.

Cette thèse contribue à l'avancement des connaissances en gestion du risque de projet TI 1) en proposant un ensemble d'hypothèses fondamentales comportementales pouvant étayer le développement de théories comportementales de gestion du risque et en offrant plusieurs pistes de recherche sous la forme de questions de recherche, 2) en élaborant des propositions sur les antécédents de préférences entre les processus expérientiels et les processus analytiques d'évaluation des risques, et 3) en élaborant et validant un modèle qui revisite l'effet de l'exposition au risque perçu sur l'intention des chefs de projets TI de répondre aux risques.

Mots clés : la gestion des risques dans les projets de technologies d'information (TI), la perception de l'exposition aux risques, réponses aux risques, la prise de décision comportementale.

Méthodes de recherche : problématisation, entrevue, enquête.

Abstract

This thesis studies information technology (IT) project risk management from a behavioral perspective. Prior studies suggest that IT project managers' perceived risk exposure (i.e., subjective assessment of threats to projects' objectives) and risk response decisions (i.e., subjective plans to perform project management activities in order to reduce risks) are sometimes different from the prescriptions in the literature. Based on the premise that a better understanding of IT project managers' actual risk management behavior can help develop risk management practices that are better suited to their needs, this thesis aims to take a step in this direction. To do so, the thesis comprises three standalone but interrelated essays.

Essay 1—a problematization-based literature review—studies what the previous IT project risk management literature, as a whole, assumes for normative purposes. It first invokes the premise that alternative conceptual assumptions about the same concepts could coexist in the literature to enable alternative research objectives. It then develops an alternative assumption set for the purpose of behavioral theory building and offers a number of directions for future research.

Essay 2—a qualitative piece—examines two types of risk assessment processes: experiential and analytical processes. It sheds some light on the use of experiential risk assessment processes, including the use of heuristics and relying upon expertise-based intuition. It offers several propositions on the determinants of preferring experiential or analytical risk assessment processes in IT projects.

Essay 3—a survey—develops a model of the antecedents of IT project managers' intention to enact certain specific risk responses. It then instantiates the model for three specific risk responses, enriches each instance with the salient beliefs of a sample of IT project managers, and tests each instance using a separate survey.

This thesis contributes by 1) proposing a set of decision-making assumptions that can be used in behavioral theories of risk management and offering several avenues for future research in the form of research questions, 2) developing propositions on the determinants of preferring experiential or analytical risk assessment processes, and 3) developing and validating a model that revisits the effect of perceived risk exposure on the risk-response intention of IT project managers.

Keywords : IT Project Risk Management, Perceived Risk Exposure, Risk Response, Behavioral Decision Making

Research methods : Problematization, Interview, Survey

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List of acronyms

EUT: Expected Utility Theory

IT: Information Technology

IS: Information Systems

PT: Probability Theory

TPB: Theory of Planned Behavior

MIMIC: Multiple Indicators Multiple Causes

Dedicated to my eternal friend, Mahsa.

Acknowledgements

This thesis was completed in a long journey with the help and support of a number of people. I would like to express my sincere gratitude to Professor Suzanne Rivard, my thesis supervisor, for her ceaseless support. Suzanne, I am indebted to you. You were patient when my work was not good enough, and you took my hands and guided me in excelling it. I was privileged to work with you, and you will always be my role model.

I would also like to thank my Ph.D. thesis committee members, Professors Henri Barki and Simon Bourdeau, for their constructive feedback. I also extend my gratitude to Professor Mark Keil for his invaluable comments. A special thanks to Professor Anne-Marie Croteau, my supervisor at the John Molson School of Business, Concordia University, where I started this journey.

I would like to express appreciation to my family for believing in me. Mahsa, Mamans, Babas, Zahra, Kayvan, and Mahshad: Thanks for being there for me when I needed you most. Maman and Baba, thank you for opening my eyes to the importance of education. Mahsa, thanks for your constant encouragements during ups and downs of this thesis, also thanks for putting up with my frustrations and sleepless nights. You are the best.

To my friends and colleagues, especially Forough Karimi-Alaghehband, Yasser Rahrovani, Mustapha Cheick Ammar, Nasser Sharasbi, Mina Rohani, Julien Meyer, Mazen El Masri, and Simon Cleveland, for all their help and support in this work.

This journey would be impossible without the support of several faculty members at the Montreal's Joint Ph.D. Program who helped and encouraged me in many different ways, especially Professors Jacques Robert, Liette Lapointe, and Stefan Tams.

Thank you to Concordia University, TD Bank Canada, JMSB, Power Corporation Canada, FQRSC, HEC Foundation, and HEC Chair in Strategic Management of Information Technologies for making this journey possible.

Preface

All three essays constituting this thesis are co-authored by Mohammad Moeini-Aghkariz and Suzanne Rivard.

Chapter 1
An Overview of the Three-essay Thesis

1.1 Introduction and Motivation

A longstanding objective of information technology (IT) project management research has been to develop practices that can increase the success rate of such projects (Mignerat and Rivard 2010). Project risk management is one such practice. In the literature, IT project risk management is generally defined by using the two broad activities of risk assessment and risk response[1] (Bannerman 2008; Boehm 1991). Risk assessment refers to identifying and analyzing (e.g., giving value to, ranking, prioritizing) threats to projects' objectives (Bannerman 2008; Boehm 1991). Risk response refers to planning mechanisms—project management practices—that aim to reduce such threats (PMI 2013).

The literature suggests that as part of project managers' function, the right to make decisions in case of risk management—as in many other project management activities—is often delegated to IT project managers (Kutsch and Hall 2005). Furthermore, IT project managers will be blamed if a project fails (Keil et al. 2007). Based on this premise, the present thesis focuses on IT project managers as key decision makers about enacting risk responses.

Within this broad context, this thesis is motivated by findings which suggest that project managers' actual risk management behaviors are different from the prescriptions in the literature (Bannerman 2008; Kutsch and Hall 2005, 2009). For example, the project managers' perceived risk exposure was found to be different from an expected-utility-based measure of risk exposure (Keil et al. 2000). Moreover, project managers have been found to completely ignore the risks that they identify (Kutsch and Hall 2005) or to suffice to plan contingencies instead of enacting specific risk responses that the researchers would expect (Taylor 2005).

[1] Note that different terms have been used in the past literature to refer to these two activities. This thesis will try to consistently use the terms employed by the Project Management Institute (PMBoK 2013).

Given these motivations, the objective of the present three-essay thesis is to increase the understanding of IT project managers' perceived risk exposure and their decisions about whether to enact specific risk responses. This objective is further inspired by the premise that a better understanding of IT project managers' perception of risk exposure and decision making regarding risk-response actions can help develop risk management practices that better suit IT project managers' needs (Taylor et al. 2012).

Having this objective, this thesis pertains to and contributes to the behavioral stream of research in the IT project risk management literature. More precisely, our review of the IT project risk management literature revealed two categories of studies about these kinds of perceptions and decisions. The first category, which includes the majority of studies on IT project risk management, is characterized by its normative/ prescriptive stance. Such studies have sought to determine how IT project managers should perform project risk management (e.g., Boehm 1991), or, more particularly, how they should assess risks (i.e., identify risk factors and evaluate the ensuing risk exposure, e.g., Barki et al. 1993) and make risk response decisions most appropriate to a given situation (i.e., identify specific risk responses, e.g., Barki et al. 2001). The second category, which includes a small number of studies, is characterized by its descriptive/ explanatory (or as we call it throughout this thesis, behavioral) stance. These studies have focused on explaining how project managers' actually apply risk management practices (e.g. Kutsch and Hall 2009; Kutsch et al. 2012), or, more specifically, how they perceive risk exposure (Keil et al. 2000) and decide upon the enactment of specific risk responses (Huff and Prybutok 2008; Keil et al. 2008).

Essay 1—a conceptual piece—investigates what the majority of IT project risk management studies assume for normative purposes and attempts to develop an alternative assumption set to enable and motivate further behavioral research. The three interrelated research questions for Essay 1 are: RQ.1 What are the fundamental decision-making concepts about which the normative assumptions underlying the risk management literature significantly differ from the way project managers often perceive and respond to risks in IT projects? RQ.2 What are such normative assumptions, and what are the alternative assumptions required for building theories to explain the risk perceptions and responses of IT project managers? RQ.3 Given these normative and alternative assumptions, what avenues for future research are opened up? By drawing upon behavioral decision theories (see March and Shapira 1987), Essay 1 contributes by developing a set of alternative assumptions for building behavioral theories of IT project risk management and by offering multiple directions for future research.

Essay 2—a qualitative piece—aims to provide a deep understanding of the processes through which IT project managers assess risks. Essay 2 addresses the question: What are the antecedents of the use of and reliance upon the experiential risk assessment processes or the analytical ones? Building on the dual-process theories of judgment (Kahneman 2011; Kahneman and Fredrick 2005) and their applications to the management context (Dane and Pratt 2007) and using a qualitative study, this essay contributes by offering several propositions.

Essay 3—an empirical piece—develops, specifies, enriches and tests a model that aims to explain IT project managers' intention to enact specific risk responses. The research question of Essay 3 is: What are the determinants of the intention of IT project managers to enact—or not to enact—specific risk responses? This essay builds on the behavioral studies of perceived risk exposure and uses the theory of planned behavior (TPB, Ajzen 1991) as a model-building canvas. The main contribution of this essay is to suggest that the relationship between the perceived risk exposure and the intention to enact specific risk responses is mediated by a subjective counterbalance of the expected desired effects and side effects of enacting the risk response. Moreover, this essay examines the influence of perceived pressures and perceived control on project managers' risk-response intentions. In doing so, it provides a granular understanding of what salient beliefs project managers hold regarding such attitudinal, pressure, and control aspects of three specific risk-response actions.

In the remainder of this chapter, the relationship between the essays and a summary of each essay are presented. By way of conclusion, the main contributions of the thesis are highlighted.

1.2 Conceptual Framework

In this section, we provide a holistic picture of what the three essays are about and how they are related. As discussed above, this thesis intends to explain IT project managers' risk management behavior, i.e., their perceived risk exposure and enactment of risk responses. As Charette (1996) states, "The risk management process is inextricably linked with our process of making decisions" (p. 373). Charette explains that this decision making is oftentimes between two project states: the project with or without enacting a risk response. Accordingly, as noted by several researchers (e.g., Kutsch and Hall 2005; Lauer 1996), the normative risk management research has—explicitly or implicitly—built on classical decision-making theories (e.g., expected utility theory, von Neumann and Morgenstern 1947) to study risk management. In line with these studies, this thesis adopts a decision-making theoretical angle whereby IT project risk management behaviors can be discussed.

Using this decision-making angle, and to demarcate the conceptual territory of this thesis, we develop a conceptual framework (see Figure 1.1). We developed this conceptual framework by abstracting the concepts and relationships commonly considered by the past literature on decision making under risk (e.g., Kahneman and Tversky 1979; Simon 1955, 1978; von Neumann and Morgenstern 1947). A description of each element of this conceptual framework follows.

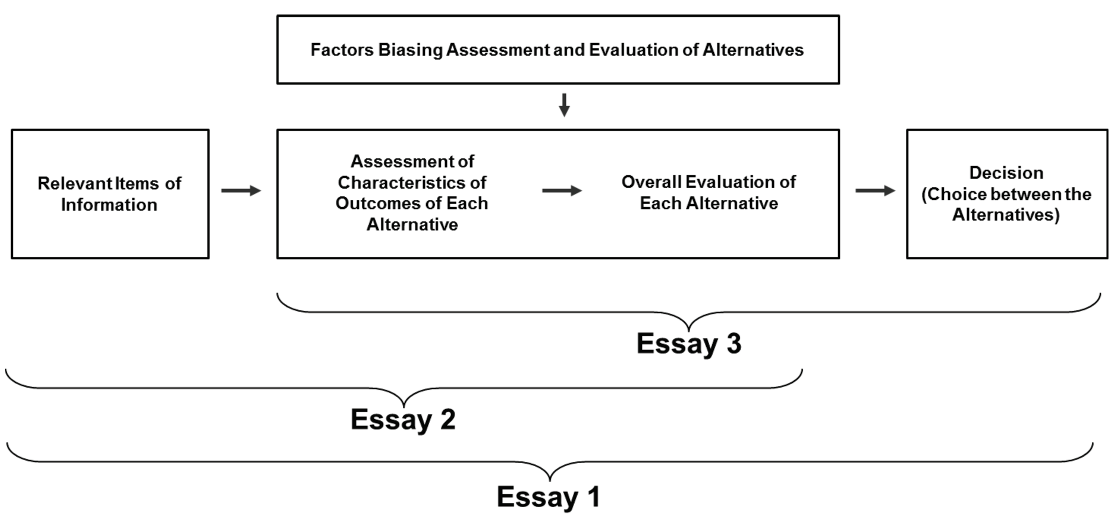

Figure 1.1 The Conceptual Framework

Decision – A decision is traditionally defined as a choice between the available decision alternatives (e.g., von Neumann and Morgenstern 1947). In the context of the present thesis, it refers to deciding about whether to enact a specific risk response (Boehm 1989). Therefore, in an abstract sense, it involves choosing between the decision alternatives of (a) not doing anything about the identified risks and simply moving on by accepting them and (b) enacting specific risk responses in the project (Boehm 1989; Charette 1996; Kutsch and Hall 2005). *Who is the decision maker?* This conceptual framework assumes that a decision maker who recognizes the need for—formally or informally—making a decision is present. As stated at the beginning, consistent with past behavioral studies of IT project risk management (e.g., Keil et al. 2000; Kutsch and Hall 2005; Lauer 1996), we focus on IT project managers as the key individuals responsible for project risk management. Thus, those cases in which this kind of decision is not delegated to project managers lie outside the boundaries of this study. *How is a decision made?* A decision is made by applying some decision criteria (e.g., maximizing) to the overall evaluation of the decision alternatives.

Overall evaluation of each decision alternative – The overall evaluation of a decision alternative refers to the extent to which the decision maker has a preference for the decision alternative. *How is each decision alternative evaluated?* This preference can be regarded as an integration of the assessments of the outcomes of a decision alternative into a single value. For example, the notion of risk exposure integrates the probability of undesirable outcomes and the magnitude of impact of such outcomes by multiplying them together (Boehm 1991).

Assessment of outcomes of each decision alternative –The assessment of outcomes of each decision alternative refers to the characterization of outcomes of each decision alternative by the decision maker. For simplicity, prior normative research has consistently focused on the single outcome of project failure for the alternative of not enacting risk responses (e.g., Barki et al. 2001) and the outcome of mitigated risk exposure for the decision alternative of enacting the risk response (Boehm 1989). For example, project failure can be characterized by various attributes such as probability of occurrence, magnitude of impact, and their controllability (Pablo 1999), with the first two being widely used by the normative risk management research (e.g., Boehm 1991). *How does a decision maker assess the outcomes of a decision alternative?* A decision maker assesses the outcomes of a decision alternative on the basis of the available relevant items of information.

Relevant items of information - Relevant items of information are the informative elements—or "cues" (Taylor 2007)—that can potentially characterize the outcomes of each decision alternative. *Where do relevant items of information come from?* Decision makers can obtain these items of information from various—internal or external—sources. For example, in the risk management context, a relevant item of information, say an estimation of a high probability of failure in a project, could be generated using a risk assessment tool (Keil et al. 2008).

Biasing factors - Biasing factors are personal, project, or organizational characteristics that, beyond the relevant items of information, could influence decision making about risk management. *How could a biasing factor influence the decision making?* Biasing factors can modify the assessments of outcomes of the decision alternatives and their evaluations by the decision maker.

As Figure 1.1 indicates, the three standalone essays that constitute this thesis cover different but overlapping parts of the explained conceptual framework. As such, these essays intersect as well as complement each other in a number of ways. Essay 1 covers the entire conceptual territory of the presented conceptual framework. Essay 2 and Essay 3 address some of the research questions developed in Essay 1 by building on some of the alternative assumptions it offers. Essay 2 focuses on identifying what motivates using subjective risk assessment processes as compared to analytical ones; therefore, it focuses on gathering relevant information and the evaluation of the decision alternative of continuing the project without enacting a risk response. Finally, Essay 3 focuses on providing an explanation for the focal construct of the presented conceptual framework, i.e., the decision. The following subsections provide a summary of each essay, a summary of the expected contributions of the thesis, and the current status of the essays.

1.3 Summary of Essay 1

Title: "IT Project Risk Management: A Problematization-based Literature Review"

Research problem and objective: Assumptions refer to propositions that are taken for granted as true (Davis 1971). Different assumptions are made for different theoretical purposes. In the decision-making literature, two such differing purposes are the normative and the behavioral stances (Slovic et al. 1977). In the past, the decision-making assumptions of IT project risk management research have absorbed the attention of some studies (e.g., Keil et al. 2000; Kutsch and Hall 2005, 2009, 2010; Lauer 1996; Taylor 2005, 2006, 2007; Taylor et al. 2012). These studies suggest that the normative perspective dominates the past literature and thus the existing assumptions serve that purpose. Nevertheless, a method-based identification of such assumptions, an evaluation and revision of them for a behavioral end, and a provision of specific directions for future research based on them are still lacking. Therefore, the main objectives of Essay 1 are to provide a set of decision-making assumptions that can be used in the behavioral studies of IT project risk management and to direct future research based on these alternative assumptions.

Method: To achieve this objective, Essay 1 uses a problematization approach (Alvesson and Sandberg 2011) in a review of 72 IT project risk management articles published over the past 25 years. According to Alvesson and Sandberg, problematization entails a set of principles to identify, articulate, evaluate, and revise the assumptions underlying a body of literature. Problematization involves reading the target articles in depth, comparing and contrasting them with other research and theories on similar phenomena, and considering one's own position, all in an iterative fashion.

Results: Our review confirmed that the majority of the past IT project risk management research has been conducted from the normative stance. Consistently, the assumptions these studies hold were found to serve the objective of finding better ways of decision making when managing IT project risks. This review revealed three specific decision-making concepts over which the normative assumptions were significantly different from the extant empirical evidence on the actual risk management behaviors of project managers: (1) the objectivity of risk assessment (i.e., gathering the relevant items of information, assessing the outcomes, and integrating them into an overall evaluation), (2) the relative importance of probability and magnitude dimensions of risk exposure, and (3) the determinants of risk-response decisions.

For each of these three concepts, the normative assumption was articulated, and an alternative set of assumptions more faithful to project managers' actual behavior was developed. For example, Normative Assumption#1 suggests that a dependable risk assessment that can be acted upon has an objective nature (e.g., method-based estimates of risk) to be the only items of information to be used in risk management. An alternative assumption—which is developed for a descriptive purpose—suggests that IT project managers do rely on subjective risk assessments when deciding upon whether or not to enact a risk response. For example, they might rely on their own past experiences.

Contributions: Our first contribution in Essay 1 is to develop a set of alternative decision-making assumptions that can be taken into account in explaining project managers' risk management behavior. In doing so, we bring systematicity and structure to the ongoing discussions of the normative assumptions and their implications (Bannerman 2008; Kutsch and Hall 2009; Taylor et al. 2012). Moreover, by suggesting that the third normative assumption is rooted in feedback control theory (e.g., Doyle et al. 2009) rather than classical decision theories such as expected utility theory (von Neumann and Morgenstern 1947), we add to the understanding of the origins of the mainstream risk management prescriptions.

Our second contribution is to offer several avenues for future research in the form of some justified research questions and suggestions on how to start answering them. This essay also makes a methodological contribution to problematization research by introducing a coherent approach to implement dialectical interrogation. We suggest and showcase that the dialectical interrogation of articles can be realized by adapting the grounded theory approach to literature reviews (Wolfswinkel et al. 2013), treating the articles as data and the assumptions as codes.

1.4 Summary of Essay 2

Title: "Identifying the Determinants of Preferring Experiential or Analytical Risk Assessment Processes in IT Projects"

Research problem and objective: Risk assessment refers to identifying risk factors and evaluating the risk exposure ensuing from them (Bannerman 2008; Boehm 1991). Reviewing the past IT project risk management literature suggests that the normative prescriptions motivate using *analytical* risk assessment processes (e.g., characterizing the outcomes and then integrating them according to a formula, possibly using risk assessment tools and techniques). On the other hand, research suggests that the actual risk assessment process used by IT project managers is still—to a large extent—*experiential* (Bannerman 2008; Ropponen 1999). Yet, research on why IT project managers sometimes prefer to act upon experiential processes is scarce. Therefore, our main objective in Essay 2 is to investigate the determinants of preferring one of these risk assessment processes over another.

Theory-building approach: To achieve this objective, and given the scarcity of prior research on experiential risk assessment in the present context, we adopted the analytic induction approach (Patton 2002). Following this approach, we first developed a preliminary specification of the two processes and their determinants to guide and bound our data collection (Miles and Huberman 1994). To do so, we drew upon the dual-process theories of cognition in the judgment and decision-making literature (Kahneman 2011; Kahneman and Fredrick 2005). This literature considers risk assessments to result from *experiential* (i.e., using heuristics and relying upon expertise-based intuition) as well as *analytical* (i.e., deliberation and method-driven analysis) cognitive processes. According to this literature, while the first process is fast, effortless, and holistic, the second one is slow, effortful, and involves decomposing the problem. Following the adopted dual-process perspective (e.g., Kahneman 2011), we also consider that *analytical* processes might either accept or overrule *experiential* ones. Moreover, by reviewing this literature, we gained an initial understanding that both individual and task characteristics can influence the preference for experiential or analytical risk assessment processes.

Research methods: Next, in accordance with our analytic induction approach, we further specified and enriched the preliminary specification of the two processes and their determinants with the findings of a qualitative study with IT project managers as key informants. Given the difficulties in eliciting experiential processes, we implemented multiple interview techniques including a concurrent think-aloud protocol (Glöckner and Witteman 2010; Patton 2002) and seeking out some real-life examples in retrospect. We interviewed 24 IT project managers. We selected them to increase the variance in their demographics. To analyze the data, we sought similarities and differences across the project managers' responses in search for replicating phenomena and patterns (Glaser and Strauss 1967; Patton 2002). We then turned the identified patterns into some propositions.

Findings: Analyzing the data revealed five determinants for choosing one risk assessment process over another (i.e., formal project management training, number of years of project management experience, perceived cognitive resources demanded by the process, perceived process accuracy, and time into project). Moreover, consistent with some dual process theories of cognition (e.g., Kahneman and Fredrick 2005), our data suggested that even when an experiential risk assessment process is used, it may be complemented with a follow-up analytical assessment. Therefore, we sought what determines performing the subsequent analytical assessment and found two such determinants (i.e., perceived need for evidence-backed-up communication of risks and perceived need for complying with an analytical risk assessment mandate).

Contributions: We contribute to the behavioral studies of IT project risk management by shedding some light on the experiential risk assessment processes that IT project managers use. In particular, we provide some empirical evidence for the use of heuristics and relying upon expertise-based intuition. Moreover, we propose various determinants for the use of experiential or analytical processes, including the characteristics of the project manager (e.g. formal project management training), the perception about the risk assessment processes (perceived accuracy), the characteristics of the project (progress), and the characteristics of the organization (e.g., existence of an analytical risk assessment mandate).

1.5 Summary of Essay 3

Title: "Responding—or Not—to IT Project Risks: Revisiting the Effect of Perceived Risk Exposure"

Research problem and objective: Early behavioral research considered perceived risk exposure as a direct antecedent of the decision of whether or not to enact specific risk responses (e.g., Keil et al. 2000). Yet, prior research suggests that when IT project managers notice a risk, they sometimes decide not to enact the corresponding specific risk responses (Kutsch and Hall 2005; Kutsch et al. 2012; Taylor 2005). Past risk management literature provides some evidence for the influence of constructs beyond perceived risk exposure on project managers' decisions to manage risks (Bannerman 2008; Kutsch et al. 2012). Nevertheless, an integrative model of these kinds of influence, especially one that specifies the relationship between perceived risk exposure and risk response decision, is still lacking. The objective of Essay 3 is to explain IT project managers' decisions of whether or not to enact a specific risk response by specifying the relationship between perceived risk exposure and this decision and by including other important determinants of this decision.

Research Model: Essay 3 conceptualizes the decision of whether to enact specific risk responses as the behavioral intention of IT project managers. It considers project managers to expect two effects from enacting specific risk responses: desired effects (including risk mitigation effects) and side effects. It conceptualizes these two counterbalancing effects to compose an overall risk response attitude. Then, at the core of the research model, Essay 3 suggests that the effect of perceived risk exposure on risk response intention is mediated through the overall risk response attitude. To back this argument with established theory, this essay refers to the notion of background factors in the theory of planned behavior (TPB, Ajzen 1991) from the reasoned action approach (Fishbein and Ajzen 2010). In addition, normative and control constructs relevant to enacting specific risk responses are included in the model. Moreover, to gain a better understanding of what influences project managers' intention to take specific risk-response actions, the granularity of the conceptualization of the principal antecedents in the model is increased by including their underlying belief composites.

Research Methods: Essay 3 includes three empirical phases. In Phase 1, three specific risks responses that are important, within control, but not frequently practiced were selected by using a survey. The selected risk responses are: having user representatives as project team members, appreciating team members' work in a tangible way during the project, and dedicating much effort to planning. Then, the proposed research model was instantiated for each of them. In Phase 2, a belief-elicitation study (Ajzen 2002; Fishbein and Ajzen 2010) was used to identify the salient desired effects, side effects, sources of pressure, and required factors for performing each of the three selected risk responses. Then, the results were used to populate the belief composites in each instance of the proposed model. In Phase 3, a survey was conducted to validate each instance of the model. For all three instances of the model, the results support the core hypothesis that overall risk response attitude mediates the influence of perceived risk exposure on risk response intention.

Findings: The results support the core hypothesis that the effect of perceived risk exposure on risk response intention is mediated by the overall risk response attitude for all three instances. Moreover, the second-order conceptualization of risk response attitude is supported. Also, perceived pressure added to the explanatory power of the model, and the influence of perceived control was mixed for different instances. The findings highlight the importance of beliefs about specific risk responses on project managers' decision to enact these responses.

Contributions: Essay 3 makes two contributions to the IT project risk management research. First, it suggests a mediated effect for perceived risk exposure and considers three key antecedents (overall risk response attitude, perceived pressure, and perceived control) for risk response intention; therefore, it sheds some light on the findings reported in the literature about the enactment of risk responses when risks are noticed (Keil et al. 2000; Kutsch and Hall 2005). Second, by running the belief-elicitation study and providing the granular beliefs, this essay provides a rich and persuasive understanding of the determinants of risk-response decisions. Essay 3 makes a methodological contribution to TPB by using the MIMIC approach (Diamantopoulos and Winklhofer 2001) to simultaneously specify the attitude, perceived pressure, and perceived control constructs as reflective ones and as belief composites.

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Chapter 2
Essay 1: IT Project Risk Management: A Problematization-based Literature Review

Abstract

Prior research reports on some differences between the ways IT project managers perceive risk exposure and enact risk responses and the normative assumptions that underlie the risk management prescriptions. In this paper, we aim to further our understanding of these differences as well as to stimulate more research in this direction by conducting a literature review that focuses on conceptual assumptions.

In this review, we first invoke the premise that alternative conceptual assumptions about the same concepts could coexist in the literature to enable alternative—here normative and behavioral—research objectives. We then seek to identify those concepts about which the normative assumptions are inadequate for a behavioral theory building objective. To do so, we adapt problematization to review 72 highly-cited studies on IT project risk management conducted over the past 25 years.

This review revealed three such concepts: (1) the objectivity of risk assessment, (2) the relative importance of probability and magnitude dimensions of risk exposure, and (3) the determinants of risk-response decision. For each identified concept, we articulate and revisit the normative assumption and develop research questions from four themes: (a) building further behavioral theories; (b) examining whether and when the normative or the alternative stance is more conducive to project success; and accordingly, (c) changing IT project managers' risk perception and behavior or (d) updating the existing risk management prescriptions. We also suggest a starting point to answer the research questions that we develop.

We contribute to theory by providing a behavioral assumption ground and opening several avenues for future research. We also contribute to methodology by introducing and showcasing how a grounded theory approach to reviews can increase the coherence of problematization.

2.1 Introduction

Since the introduction of computers to businesses five decades ago, information technology (IT) projects have been challenging undertakings (Bloch et al. 2012; Flyvbjerg and Budzier 2011). Over time, researchers have sought project management practices that would improve the chances of project success. One such practice is project risk management (Alter and Ginzberg 1978; Boehm 1989; Barki et al. 2001; Keil et al. 1998; Taylor et al. 2012), which is often viewed as one of the fundamental tasks of project managers (PMI 2013). In essence, risk management involves risk assessment (i.e., identifying risk sources that pose threats to a project's success and evaluating risk exposure or probable loss due to the identified risk sources) and risk response (i.e., enacting managerial interventions to mitigate risk exposure). Researchers have developed a wealth of prescriptions to guide and facilitate these tasks. To do so, they have consistently framed the enactment of risk responses as a decision; then, with the view that "[r]isk management methods specify search procedures for information gathering, organization and interpretation to simplify complex decisions" (Lyytinen et al. 1996, p. 276), they have developed prescriptions using normative decision-making theories. Implementing the offered prescriptions has been suggested as a way to increase the success rate of IT projects (Barki et al. 2001; Jiang and Klein 2000; Wallace and Keil 2004).

While most IT project risk management studies have been conducted from such a normative view, a few have adopted a behavioral stance and examined how project managers perceive risks and respond to them. These behavioral studies report that although the necessity of project risk management is agreed on in principle, the risk perceptions and behaviors of IT project managers "often vary from prescriptions in the literature" (Bannerman 2008, p. 2118). For example, risk management prescriptions—as a whole—imply focusing on all relevant risk sources, providing a precise evaluation of risk exposure, and enacting risk responses that correspond to the risk sources; however, IT project managers sometimes focus on some risk sources but not others (Keil et al. 2008), unintentionally over- or underestimate risks (McGrew and Bilotta 2000), and decide not to enact risk responses to the noticed risk sources (Kutsch and Hall 2005).

Prior research has suggested that such differences between risk perceptions and behaviors and the prescriptions are founded at the level of the normative assumptions underlying the theories from which the prescriptions are derived (Bannerman 2008; de Bakker et al. 2010; Kutsch and Hall 2009). When these differences are significant, two important issues arise. First, the normative assumptions become insufficient for explaining the risk perceptions and behaviors of IT project managers; therefore, attempts to build behavioral theories can violate these assumptions. Second, such normative assumptions make prescriptions appear restrictive (Kutsch and Hall 2009), difficult to apply (Taylor et al. 2012), or even unrealistic to apply (Pfleeger 2000); thus, if not appropriately addressed, these assumptions can reduce the likelihood of a purposeful application of prescriptions by IT project managers. These issues motivate revisiting such normative assumptions, developing alternatives to them, and discussing the implications of assumption-level differences.

Although a few researchers have recently alluded to the normative assumptions underlying risk management research (e.g., de Bakker et al. 2010; Kutsch et al. 2012; Taylor et al. 2012), an integrative review that focuses on these assumptions and explicates their implications for future research is lacking. In this paper, we conduct such a review, responding to recent calls for reviews that "strive to identify thematic gaps and theoretical biases, propose some future research directions, including alternative theoretical underpinnings, and not just stop at the summarizing/synthesizing stage" (Rowe 2014, p.250).

It is important to note that by discussing the differences between the normative assumptions underlying the literature and the risk perceptions and response behaviors of IT project managers, we do not intend to imply that the assumptions are fallacious; alternatively, we seek to better understand and then address these differences with the ultimate goal of closing the research-practice gap in IT project risk management (Bannerman 2008; Taylor et al. 2012). Given the prevalence of normative studies, we believe that the differences could be better understood by first increasing our knowledge of the actual risk management behavior of IT project managers, and then comparing these behaviors with the normative prescriptions on their impact on project success. Then, based on this understanding, the differences could be addressed by encouraging project managers to follow the prescriptions when the prescriptions outperform their behavior, or by updating the existing prescriptions when there is an advantage on how project managers manage project risks.

To structure our effort, we ask three interrelated questions:

RQ.1 *What are the fundamental decision-making concepts about which normative assumptions that underlie the risk management literature significantly differ from the way project managers often perceive and respond to risks in IT projects?*

RQ.2 *What are the normative assumptions? What are the alternative assumptions required for building theories to explain the risk perceptions and responses of IT project managers?*

RQ.3 *Given the normative and alternative assumptions, what avenues for future research are opened?*

To answer these questions, we review the IT project risk management literature by using a problematization method, which is a way of developing new research questions through identifying, articulating, evaluating, and revisiting the assumptions underlying a body of literature (Alvesson and Sandberg 2011). The main mechanism of problematization is dialectical interrogation, i.e., the iterative comparison and contrasting of various studies about a particular topic so that their assumption-level differences surface. We applied dialectical interrogation to a sample of 72 highly-cited IT project risk management articles published during the last 25 years.

This effort has led us to identify three fundamental decision-making concepts, about which there are significant differences between the normative assumptions and the evidence in the literature on how IT project managers perceive risks and decide on whether to enact risk responses. These areas of difference are: (1) the objectivity of risk assessment, (2) the relative importance of probability and magnitude dimensions of risk exposure, and (3) the determinants of risk-response decisions. For each of these concepts, we articulated the normative assumption, provided—empirical or anecdotal—evidence from the literature for the difference, and proposed an alternative assumption. Then, to direct future research, we proposed a series of research questions that pertain to four themes: (1) developing more profound theories of risk perception and behavior based on the alternative assumption, (2) evaluating whether the normative or the behavioral stance is more conducive to project success and, on the basis of this, determining what should be done next in terms of (3) changing the risk perceptions and behaviors of IT project managers, or (4) revising the IT project risk management prescriptions.

We make two contributions to the IT project risk management research. First, we contribute to the study of risk perceptions and behaviors by offering an alternative conceptual foundation. In particular, by adapting the problematization methodology to this review, we bring systematicity and structure to the ongoing discussions of the normative assumptions and their implications (Bannerman 2008; Kutsch and Hall 2009; Taylor et al. 2012). Moreover, by suggesting that the third normative assumption is rooted in feedback control theory (e.g., Doyle et al. 2009) rather than classical decision theories such as expected utility theory (von Neumann and Morgenstern 1947), we add to the understanding of the origins of mainstream prescriptions. Second, we contribute to proposed research programs (e.g., Sauer et al. 2008) by emphasizing the need for behavioral studies and by opening some research avenues in this direction. We also make a methodological contribution to the problematization research by introducing a coherent approach to implement dialectical interrogation. We suggest and showcase that the dialectical interrogation of articles can be realized by adapting the grounded theory approach to literature reviews (Wolfswinkel et al. 2013), treating the articles as data and the assumptions as codes.

In the following section, we provide a more detailed explanation of our adaptation of the problematization methodology. We then present our findings, focusing on one emerging fundamental decision-making concept at a time, presenting the assumptions, and offering directions for future research. We conclude by summarizing our proposed research agenda and discussing its implications for future research.

2.2 Problematization Approach

This review was based on a problematization approach proposed by Alvesson and Sandberg (2011). Since assumptions are central in this effort, we first shed some light on the notion of assumptions and then explain our approach to identifying and discussing them.

An assumption is a proposition that is taken for granted as true (Davis 1971). This review focuses on conceptual assumptions. Conceptual assumptions "can be thought of as 'second order explanations'—the implicit whys underlying an explicit answer to a specific why question" (Whetten 2002, p. 58). Conceptual assumptions are integral to the definition of constructs and the explanation of their relationships.

Alternative assumptions about the same concept could coexist in the literature, because the assumptions are often held in line with research objectives (Davis 1971) and different studies may have different research objectives. Making alternative conceptual assumptions leads to defining constructs in a different way or to developing alternative theories. In the IT project risk management context, most studies have the normative purpose of increasing the success rate of projects and hold normative assumptions to this end. However, we seek to develop alternative assumptions for the objective of explaining how IT project managers actually perceive risks and decide on enacting risk responses.

While scrutinizing the assumptions and developing alternatives to them is potentially 'interesting' (Davis 1971), it is a challenging task as assumptions are often implicit. One way of making them explicit is to compare and contrast different studies on the same concept in light of one's knowledge of relevant theories so that their different views surface. This approach, called the dialectical interrogation of articles, is structured by problematization methodology (Alvesson and Sandberg 2011). Problematization helps generate new research questions by identifying, articulating, evaluating, and revisiting assumptions; thus, we found it appropriate for addressing both research questions of this review.

Our adaptation of problematization, however, complements the guidelines put forth by Alvesson and Sandberg (2011) in two ways. First, extending the work of Davis (1971) on denying assumptions, the problematization methodology challenges assumptions in the sense that they are necessarily "wrong." Yet given our premise that alternative assumptions about the same concept could coexist, we only investigate the adequacy of the dominant normative assumptions for developing behavioral theories and develop alternative assumptions to this end where required. We nevertheless propose the discussion of the validity of the normative assumptions vis-à-vis the intended purpose of increasing the success rate of IT projects as a direction for future research.

Second, in a conventional sense, assumptions comprise descriptive propositions that focus on how things *are* (e.g., an assumption stating that X is Y). However, owing to the normative nature of some of the risk management studies that we review, some of the propositions that they often accept as true are not framed as descriptive ones; rather, they are prescriptive propositions that focus on how things *should be*, implying how things *can be* and *will be* (e.g., an assumption that X should be Y, implying that X can and will be Y). In our view, these prescriptive propositions are akin to assumptions as they are made repeatedly, with their feasibility and practice taken for granted as true— i.e., often without a discussion of the complications involved in implementing them. Therefore, to be faithful to the normative studies that we review, we extend the problematization by widening our view of an assumption to comprise prescriptive propositions in addition to descriptive ones.

Table 2.1 depicts the key steps in our review based on the guidelines of problematization methodology, and the following three subsections explain these steps.

Table 2.1 Problematization Steps

Main Steps in Our Study	Corresponding Step(s) in Problematization Methodology (Alvesson and Sandberg 2011)
Creating a balanced pool of normative and behavioral articles	1 - Identifying a domain of literature
Articulating the—normative and alternative—assumptions	2 - Identifying and articulating assumptions 3 - Evaluating articulated assumptions 4 - Developing alternative assumptions
Providing directions for future research	5 - Relating assumptions to audience 6 - Evaluating alternative assumptions

2.2.1 Creating a Balanced Pool of Normative and Behavioral Articles

We started by creating a pool of articles to be reviewed in a systematic way (Rowe 2014). Using online databases (i.e., EBSCOHost/Business Complete and ABI/INFORM), we searched for the term "risk" in the titles and abstracts of the articles in the past 25 years of the AIS basket of 8 journals. We then examined the abstracts to verify if the identified articles are relevant to risk management in IT/IS/Software development and/or implementation projects. For each retained article, we next searched forward and backward (Webster and Watson 2002), expanding our initial basket of journals to include papers from peer-reviewed conference proceedings and articles published as book chapters. This search resulted in an initial pool of 267 articles (Table 2.2).

Table 2.2 The Composition of the Pool of Articles in Terms of Publication Outlets

Journal	Identified Articles (in the Initial Search)	Included Articles (After Applying the Criteria of Inclusion/Exclusion)	Investigated Articles (After Balancing the Perspectives, Sorting by Citation Count, and Reaching Saturation)
Journals in the AIS basket of 8	***88***	***43***	***28***
European Journal of Information Systems	9	5	*2*
Information Systems Journal	7	2	*1*
Information Systems Research	3	2	*2*
Journal of Information Technology	17	10	*9*
Journal of Management Information Systems	13	5	*4*
Journal of Systems and Software	25	16	*9*
Journal of the Association for Information Systems	2	2	-
MIS Quarterly	12	1	*1*
Other journals with more than 4 articles included	***96***	***61***	***32***
Communications of the ACM	14	7	*6*
Communications of the AIS	5	4	*2*
IEEE Software	28	21	*11*
IEEE Transactions on Engineering Management	11	5	*1*
IEEE Transactions on Software Engineering	10	3	*2*
Information & Management	6	4	*3*
International Journal of Project Management	11	8	*4*
Project Management Journal	11	9	*3*
Other publication outlets	***83***	***43***	***12***
Total	**267**	**147** (55.1% of the identified articles)	**72** (49.0% of the included articles)

At this point, we specified the boundaries of our review and used them as the criteria for inclusion or exclusion of articles. We included articles that focus on:

1. project managers, but not other stakeholders such as users or project team members, because project managers are responsible for project success and risk management is part of their function (PMI 2013);
2. in-house projects, but not outsourced ones, to limit the variation on the nature of risk management and the role of project managers in this process;
3. the risks during the 'project', but not the financial risks considered before investing in a project (e.g., Dewan et al. 2007) or the business risks after the system is delivered, to focus on the risks that are more likely to be within the locus of control of a project manager;
4. the genuine risk perceptions and risk response plans of IT project managers (i.e., the perceptions and plans that the project managers personally believe in), but not the ones that are intentionally distorted (e.g., over- or underestimated) for project status reporting purposes (Iacovou et al. 2009), because the genuine ones are more likely to motivate actual behavior; and finally,
5. the behavioral and/or normative aspects of IT project risk management, but not only the normative research, because we need both types of understanding to enable dialectical interrogation.

After applying these criteria, 147 articles were retained.

As expected, the articles having normative research objectives were dominant at this point—a quick investigation suggested that 62.6% of the included articles had a normative objective, 24.5% had a behavioral objective, and 12.9% had a mixed (i.e., behavioral and normative) objective. Yet applying dialectical interrogation required comparing and contrasting a reasonable number of articles from both perspectives; therefore, we balanced the pool by retaining an equal number of articles from each stance. To do so, we first mapped the articles on the basis of their primary research objectives onto two categories of normative and behavioral/mixed (see Appendix A for the coding scheme). We combined the studies having a behavioral and mixed objective into one category due to the small number of behavioral studies and in order to have enough articles that concern some behavioral aspects of risk management. We then sorted the articles in each category according to their Google Scholar citation count as of December 2014. Then, when applying dialectical interrogation, we kept adding an equal number of articles from the top of these categories to our investigation pool until we reached saturation. This resulted in investigating 72 articles, which is 36 from each category (see Appendix B for a list).

2.2.2 Articulating the—Normative and Alternative—Assumptions

After creating the pool of articles, we applied dialectical interrogation to articulate their assumptions. Alvesson and Sandberg (2011) broadly explain that dialectical interrogation comprises reading the articles in-depth and comparing and contrasting them with other relevant studies in an iterative fashion. To make such a delicate process more coherent, we benefited from implementing dialectical interrogation as an adaptation of the Grounded Theory Literature Review Method (Wolfswinkel et al. 2013). We particularly followed the recommendations of Wolfswinkel et al. (2013) to implement an 'analyze' stage because it "shows how qualitative research methods, rooted in Grounded Theory, extract genuine value from the selected studies" (p. 46). In this stage, the findings of the review emerge through a coding process in which the data are the content of the articles and the codes are their various attributes—in this instance, their underlying decision-making assumptions. By using grounded theory as an approach for literature reviews, we not only can follow the coding techniques of grounded theory, but at a higher level, we can focus on the emergence of phenomena and interrelationships from the data rather than from our preconceptions.

We particularly implemented open and axial coding of the articles. According to Wolfswinkel et al. (2013, p.50), open coding in the Grounded Theory Literature-Review Method "is done in order to identify, (re-)label and/or build a set of concepts and insights based on the excerpts supported by the papers." In order to articulate the assumptions through a coding process, our central premise was that an assumption could manifest itself in different ways in the literature. These manifestations could be either directly stated or inherited from another article because, as Alvesson and Sandberg (2011) suggest, building on a theory means inheriting its assumptions. Postulating this premise, we performed open coding of data (Strauss and Corbin 1990). As depicted in Figure 2.1, for each decision-making concept that emerged (through open coding) as a significant area of difference, we first performed an open coding of the—normative and behavioral—manifestations with the objective of staying close to the data. We started by generating some initial codes. For fundamental decision-making concepts, we drew upon decision-making studies (March and Shapira 1987; Simon 1955; 1978). Likewise, for manifestations of the assumptions, we referred to extant discussions of the risk management assumptions inside (e.g., de Bakker et al. 2010; Kutsch and Hall 2009) and outside (e.g., March and Shapira 1987) the IT domain.

We next performed axial coding, where "the interrelations between categories and their sub-categories (including their properties) are identified" (Wolfswinkel et al. 2013, p.50). We thus merged multiple relevant manifestations of assumptions into fewer, more abstract assumptions. Following the problematization approach, our effort was informed by our knowledge of relevant theories; we thus sought and included theoretical support for each assumption.

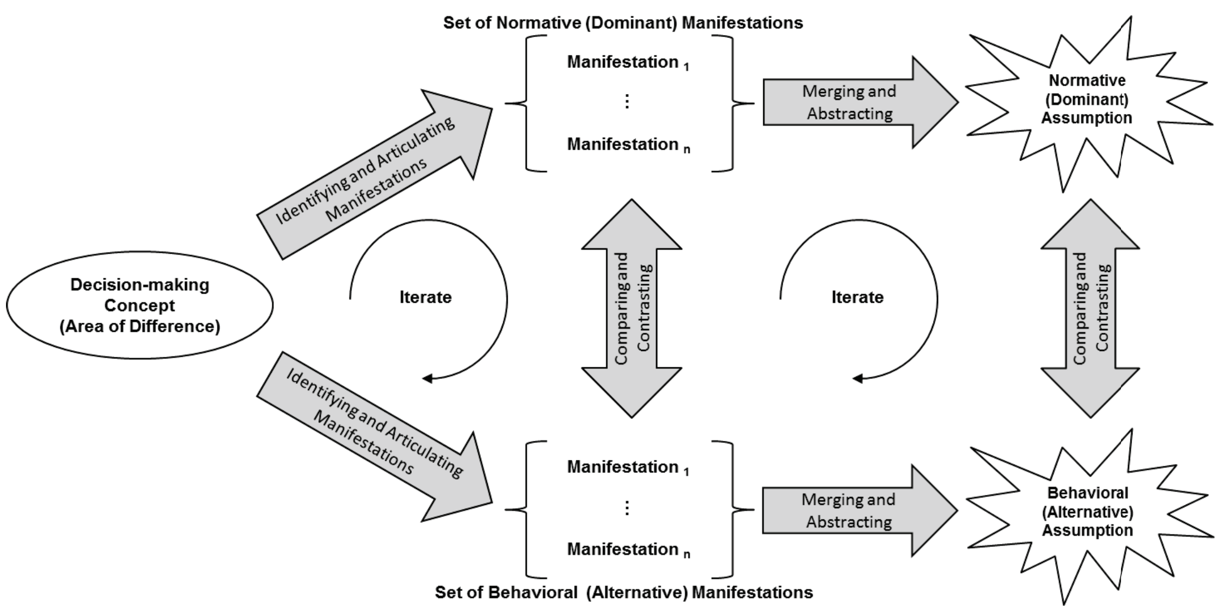

Figure 2.1 Implementing Dialectical Interrogation as a Coding Process

In this process, each code was assigned to a unit of meaning. A risk management article might touch more than one decision-making concept (e.g., risk exposure, risk response).

Therefore, whereas for creating a balanced pool of articles our unit of meaning was the statement of research objectives, for implementing dialectical interrogation it varied from a short excerpt from an article (especially when assumptions were explicit) to an article as a whole (particularly when assumptions were implicit). When possible, we extracted the unit of meaning as a short excerpt to provide evidence for the manifestation, although the manifestation would be more visible in the context in which it was situated. Moreover, if an article was irrelevant to any manifestations of an assumption, it was not forced onto one and was coded as irrelevant. The coding was a highly iterative process, in part, because we tried different wordings for manifestations and assumptions, and each change in wording warranted a verification of pertinent excerpts. The coding process was continued until we reached saturation. Overall, approximately 1100 pages of articles were scrutinized and coded.

2.2.3 Providing Directions for Future Research

In the final step, and having articulated the normative and the behavioral assumptions about the same decision-making concepts, we offered some avenues for future research. Our aim was not to exhaust the ideas but to discuss the research opportunities that we deemed important and interesting. In particular, for each pair of assumptions, we developed research questions pertaining to four themes (Figure 2.2).

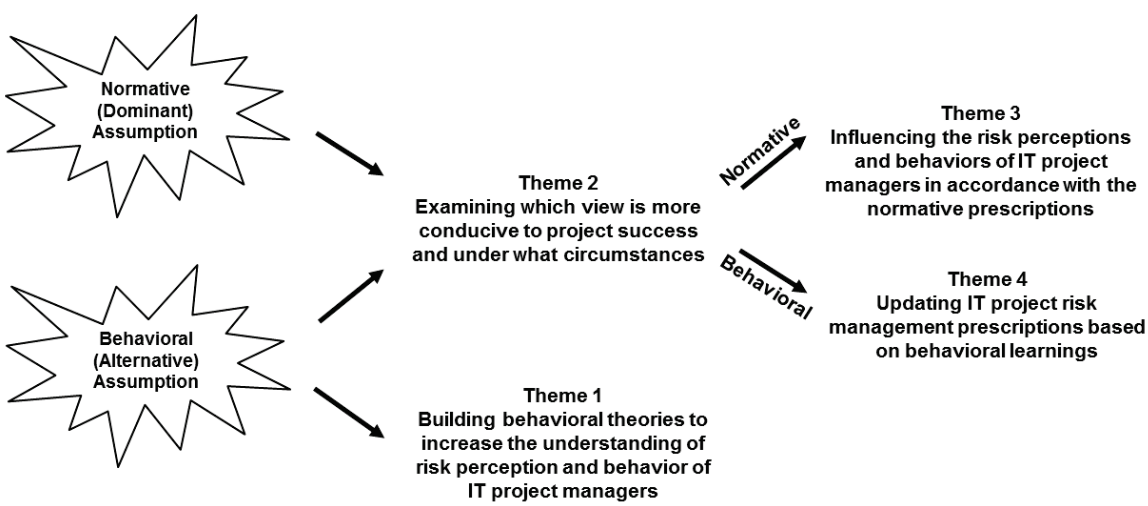

Figure 2.2 Four Themes to Direct Future Research

Theme 1 calls for building further theories using the alternative assumption to better explain and predict (Gregor 2006) the risk perceptions and behaviors of IT project managers. The alternative assumptions could be used to redefine existing constructs and to expand the boundaries of existing research, for example, by examining additional antecedents. Theme 2 motivates examining which stance (normative or behavioral) would be more conducive to project success and when. In essence, it calls for challenging the validity of normative assumptions for the purpose of accomplishing more successful projects in light of the behavioral assumption. This is motivated by the statement that

> At first blush, pure models of rational choice seem obviously appropriate as guides to intelligent action, but more problematic for predicting behavior. In practice, the converse seems closer to the truth for much of economics. [...] For if there is sense in the choice behavior of individuals acting contrary to standard engineering procedures for rationality, then it seems reasonable to suspect that there may be something inadequate about our normative theory of choice or the procedures by which it is implemented. (March 1978, pp. 588-589)

From the learnings gained from Theme 2, two orthogonal themes—both calling for theories for design and action (Gregor 2006)—arise: If the normative stance is more conducive to success, Theme 3 encourages finding ways to influence IT project managers to better follow risk management prescriptions. This theme corresponds to the observation that "[o]ne of the biggest challenges still in the IT project domain is to convert our research understanding of IT risks and risk management into practical, usable tools that are easy to implement and effective in practice" (Taylor et al. 2012, p. 18). Alternatively, Theme 4 motivates efforts to amend risk management theory and practice to incorporate learnings from the observed risk perception and behavior of IT project managers.

2.3 Findings and Research Directions

By using problematization, our review of the literature led us to identify three decision-making concepts about which there exist significant differences between the normative assumptions and the risk perceptions and behaviors of IT project managers reported in the literature. These areas of difference are (1) the objectivity of risk assessment, (2) the relative importance of the probability and magnitude dimensions of risk exposure, and (3) the determinants of a risk-response decision. In each of the following subsections, we focus on one of these areas of difference. As different assumptions provide a different level of richness in deepening our understanding, we discuss them in differing levels of detail.

2.3.1 Decision-making Concept 1: The Objectivity of Risk Assessment

From a decision-making perspective on risk management, deciding upon whether or not to enact a risk response begins with a risk assessment, i.e., identifying risk sources and then evaluating their risk exposure to see how significant the undesired outcomes could be. The first **area of difference** focuses on the objectivity of risk assessment.

(a) Normative assumption: *A dependable risk assessment that can be acted upon has an objective nature.*

This assumption implies that IT project managers' risk response decisions are mainly based on the output of tools (e.g., risk archives, risk checklists, risk exposure instruments) and techniques (e.g., conducting risk assessment sessions) that are designed to increase the accuracy of project risk assessment. Therefore, the assumption implies that IT project managers' subjective identification of risk sources and evaluation of risk exposure, without using tools and techniques, is unreliable for deciding about enacting risk responses.

This assumption is rooted in two fundamental theories of decision making: probability theory (PT, Pascal and de Fermat, 17th century) and expected utility theory (EUT, von Neumann and Morgenstern 1947). Both PT and EUT are based on the idea that the value of a decision outcome is proportional to the probability of its occurrence. While PT uses the monetary amount of a decision outcome and looks at the expected value, EUT uses the utility of this monetary amount and focuses on the expected utility. PT/EUT assume decision making to be based on a perfect knowledge of the distribution of decision outcomes, which comprises the range of possible outcomes as well as the probability and magnitude values of each outcome. They imply that the existing information about decision outcomes should be reduced into one overall evaluation of the decision alternative by following a certain formula. From these theories, therefore, the resulting evaluation is based on perfect information.

Our review revealed that several researchers have suggested that PT/EUT are the fundamental theories used by the risk management literature (Drummond 1996; Kutsch and Hall 2009; Lauer 1996). For example, Kutsch and Hall (2009) suggest that EUT "provides the fundamental assumptions that underline project risk management" (p. 73). While early IT project risk management studies (e.g., Boehm 1991; Charette 1989) "explicitly discuss expected utility theory" (Lauer 1996, p. 288), many of the studies that followed have done so implicitly by building on earlier works (e.g., Boehm 1991). Our review revealed numerous manifestations of the normative assumption in the literature (see Table 2.3).

While original PT/EUT assume the distribution of decision outcomes as given, the notion of bounded rationality suggests that "the actor has only incomplete information about alternatives" (Simon 1972, p. 163). Therefore, normative adaptations of PT/EUT have responded to this limitation by developing ways to obtain or generate risk information that are *as objective as possible* but require only a *reasonable amount of effort* (March 1978). According to March, two such responses are creating knowledge bases and approximation.

First, creating a knowledge base allows decision makers to store information from past experiences to create an intelligence that informs future decision making, for example, in the form of a distribution of decision outcomes. Accordingly, manifestation (A) suggests that *objective methods to store and retrieve information should/can/will be used to identify risk sources and to evaluate risk exposure*.

Moreover, when the distribution of decision outcomes is not immediately available from such knowledge bases, decision makers may approximate the information about the outcomes (March 1978). From this view, manifestation (B) states that *objective methods to approximate risk information should/can/will be used to identify risk sources and to evaluate risk exposure*. In a risk management context, the probability of undesired outcomes is approximated using proxies such as the extent to which the causes of such outcomes, called risk sources (also, risk factors, risk items, or risk drivers), are present. In this vein, Barki et al. (1993) state that "[i]n lieu of estimating probabilities of undesirable events in assessing risk, alternative risk evaluation methods identify and assess factors that influence the occurrence of these events" (p. 206). To do so, first the range of possible undesired outcomes is approximated using the risk checklists. Then, the probability of overall undesired outcomes is estimated by either counting the number of relevant risk sources (e.g., Keil et al. 2008) or by rating the strength of each risk source and then aggregating these strengths using statistical methods (e.g., Wallace et al. 2000a).

Another manifestation (C) states that *the items of risk information should/can/will be reduced into an overall evaluation by using a predetermined formula.* This is performed either directly through performing a calculus or indirectly by using a tool that embeds the formula. Most articles holding this assumption base their definitions and operationalizations of risk exposure on PT/EUT-based risk exposure and suggest that the probability of undesired outcomes and magnitude of loss if such outcomes occur should be combined in a multiplicative fashion.

Justifying as to why objective methods are dependable for action, manifestation (D) suggests that *the use of objective methods will increase the accuracy of risk assessment*. From this view, the methods are 'objective' insofar as they prevent systematic deviations from perfect identification of risk sources and evaluation of risk exposure, e.g., ones performed by impartial risk experts that have perfect knowledge of outcome distribution and follow a prescribed calculus. In a similar vein, objectivity has manifested (E) itself through suggesting that *the subjective risk assessments are not dependable and thus should not be acted upon*. For example, managers might believe that "[m]anagement is a 'right brain' activity. Decisions supported by analysis are defensible even if they are wrong, whereas intuition is inadmissible even if it is accurate" (Drummond 1996, p. 354).

Finally, another way in which the dependability of objective efforts has manifested (F) is through the research designs: *To assess risks, researchers have preferred to use objective methods (that indirectly identify risk sources and measure risk exposure, e.g., a risk-factor-based instrument) over the direct measures of the perceived risk of IT project managers.* Articles exhibiting this manifestation, therefore, approximate the risk exposure rather than using perceptual measures. In the language of measurement, this resembles a difference between measuring a construct using a proxy measure—which could be a formative index (i.e., asking questions about its multiple causes)—rather than a perceptual, reflective measure (i.e., asking questions about its indicators).

Table 2.3 Decision-making Concept 1: The Objectivity of Risk Assessment

Normative: A dependable risk assessment that can be acted upon has an objective nature.		**Statistics:** Manifestations found in 43 of 63 relevant articles.
Manifestations of The Assumption	**# of Codes**	**Sample Excerpts**
[A] Objective methods to store and retrieve risk information should/can/will be used to identify risk sources and to evaluate risk exposure.	2	(Wallace et al. 2004a, p. 307) "Practitioners can use the instrument to develop historical databases of the risks associated with different projects and their outcome. Compilation of this information could provide a means of assessing future projects. (Madachy 1997, p. 53) "Knowledge-based assistance. […]There is great potential for capturing expertise to assist in project management functions such as cost estimation and risk management."
[B] Objective methods to approximate risk information should/can/will be used to identify risk sources and to evaluate risk exposure.	13	(Tiwana and Keil 2004, p. 73) "This article examines the relative importance of six key drivers of software project risk and introduces a one-minute risk assessment tool that can be applied to improve software practice." (Wallace et al. 2004a, p. 307) "The measures developed in this research can be used to provide an early warning of potential project problems so that corrective action can be taken to avoid project failure."
[C] The items of risk information should be reduced into one overall evaluation by using a predetermined formula.	14	(Boehm 1991, p. 33) "RE =P(UO) * L(UO)" (Barki et al. 2001 p.43) "'risk exposure' is defined as this probability multiplied by the loss potential of the unsatisfactory outcome."
[D] The use of objective methods will increase the accuracy of risk assessment.	6	(Schmidt et al. 2001, p. 8) "With a risk factor checklist, project managers can avoid overlooking some risk factors." (Keil et al. 2000a, p. 145) "To help managers appraise project risk more accurately, IS researchers have developed a variety of risk assessment tools including checklists and surveys. Implicit in this line of research, however, is the assumption that the use of such devices will lead to more accurate risk perceptions"
[E] The subjective risk assessments are not dependable and thus should not be acted upon.	4	(Drummond 1996, p. 354) "Management is a 'right brain' activity. Decisions supported by analysis are defensible even if they are wrong, whereas intuition is inadmissible even if it is accurate" (Fan and Yu 2004, p. 193) "Subjective ways to manage project risks are common in current practice. Such approaches are human-intensive and opaque."
[F] To assess risks, researchers have preferred to use objective methods over the direct measures of the perceived risk of IT project managers.	5	(Han and Huang 2007, p. 43) "A risk assessment method is used to quantify the degree of importance of software risks to project performance." (Barki et al. 2001) [The authors have used a risk instrument to test their model rather than the criterion variable—project managers' risk perception—that they have measured.]
Behavioral: IT project managers do rely on subjective risk assessments when deciding upon whether or not to enact a risk response.		**Statistics:** Manifestations found in 27 of 63 relevant articles.
Manifestations of The Assumption	**# of Codes**	**Sample Excerpts**
[G] IT project managers decide upon enacting risk responses based on subjective ways of assessing risks.	9	(Ropponen 1999, p. 256) "Most managers seem to be managing projects based on their past experience, following 'gut feeling' and hoping for 'good luck'" (Lauer 1996 p.288) "Software projects involve sequences of judgements and choices on the part of, among others, the software project manager."

[H] There are some issues with the objective risk assessment methods that overlap with the advantages of the subjective ones.	16	(de Bakker et al. 2010, p. 500) "A reason why quantitative risk analysis is not considered useful may be that many of the risks in IT projects are not aleatoric in nature (they are not based on probability), but epistemic, which means that there is not enough information available to take a decision." (Drummond 1996, p. 355) "What Taurus teaches us is important so much as knowing the limits of their information […] and indeed the potential of their intuition."
[I] IT project managers do not widely use the objective risk assessment methods.	6	(Taylor 2005, p. 441) "And while further quantitative risk analysis on any high risk items is a recommended approach …, none of the respondents carried out any quantitative assessments." (Carr 1997, p. 24) "In working with organizations I have found that for the most part risk identification and analysis is performed on an ad hoc basis, generally at the beginning of the project through a brainstorming session by senior engineers."
[J] IT project managers process risk information in a more holistic, experiential way than calculating according to a prescribed formula and in a quantitative fashion.	2	(Bannerman 2008, p. 2119) "Managers see risk in less precise ways." (Taylor 2005 p. 439) "The responses to the risk questions rarely took the form of an explicit estimate of impact and probability for a risk item. […] usually assessed either on a yes/no basis" or "applied, or with an estimate of whether the risk was a low, medium or high item with no differentiation between size of impact and likelihood of occurrence."
[K] Even when the objective risk assessment methods are used, their outputs have no or limited influence on the risk response decisions of IT project managers.	3	(Du et al. 2007, p. 279) "It appears that risk perceptions for experts were not influenced by use of the tool because they already possessed domain knowledge of the relevant risk factors." (Kutsch and Hall 2005, p. 597) "Elsewhere, risk management was treated as a 'box-ticking' exercise, suggesting that risk management was held in low regard as an activity. Risk management was treated as an administrative task rather than a management task: Not believing that the risk estimates are legitimate"
[L] IT project managers' identification of risk sources and evaluations of risk exposure are subject to biases (implying that subjective methods such as heuristics are used to evaluate risk exposure).	14	(Huff and Prybutok 2008, p. 37) "Low-risk-propensity individuals concerned more with the potential undesirable consequences of their decisions than the gains of potential success are internalizers. They focus on how actions are going to affect them and avoiding feelings of failure." (Boehm 1991, p. 32) "Frequently, these projects were swept along by a tide of optimistic enthusiasm during their early phases that caused them to miss some clear signals of high-risk issues that proved to be their downfall later."

(b) Alternative assumption: *IT project managers do rely on subjective risk assessments when deciding upon whether or not to enact a risk response.*

This assumption implies that besides the results of the used objective methods, if any, IT project managers will decide upon risk responses on the basis of subjectively-derived items of information that might be less than perfect.

Support for this assumption could be drawn from the behavioral decision making literature (Slovic et al. 1977), which highlights the role of individuals and explains how and why subjectivity underlies decision making. In this literature, such subjective identification of risk sources and evaluation of risk exposure are referred to as perceived risk or risk perception (i.e., subjective assessments of risks involved in a situation [Slovic

1987]) or risk judgments (with judgments referring to the "subjective assessments made as a prelude to taking action" (Solomon and Trotman 2003, p. 396). We broadly refer to such subjective views of risks as perceived risk exposure to emphasize its difference from a PT/EUT-based risk exposure and to focus on risk exposure (probable loss) and not only risk (probability of a loss).

The role of subjectivity has manifested itself in the IT project risk management research in many ways. The first manifestation (G) explicitly suggests that *IT project managers decide upon enacting risk responses based on subjective risk assessments*. Besides the use of deliberate and sophisticated analysis, judgments are often performed using heuristics, i.e., mental shortcuts (Tversky and Kahneman 1974). Two concepts closely relevant to the notion of heuristic thinking are intuitions and gut feeling. An intuition refers to "a judgment that is fast in consciousness, whose underlying mechanism is unconscious, yet is nevertheless strong enough to act upon" (Gigerenzer 2008, p. 23). Considering that "heuristics can be used with and without awareness," use of them without awareness "provides a potential mechanism of intuition" (Gigerenzer 2008, p. 23). Moreover, intuitions are "affectively-charged judgments" (Dane and Pratt 2007, p. 40), and such "affective charge is subjectively experienced as an output referred to colloquially as 'gut feel'" (Akinci and Sadler-Smith 2012, p. 116). An example of heuristics is availability, which refers to reliance on accessible information (e.g., what happened last time) for judgment and decision making (Tversky and Kahneman 1974).

Another manifestation (H) is through justifying why subjective methods are used, suggesting that *there are some issues with the objective risk assessment methods that overlap with the advantages of the subjective ones*. First, the use of methods takes time and effort, especially if used frequently. In contrast, heuristics and intuitions are "fast" and "frugal" (Gigerenzer and Gaissmaier 2011) because they use only part of the available information and ignore the rest (Gigerenzer and Gaissmaier 2011; Shah and Oppenheimer 2008) and they estimate the answers to complex questions by answering similar but less complex ones (attribute substitution theory, Kahneman and Fredrick 2002). Therefore, given that IT projects are usually time sensitive and project managers are cognitively burdened with achieving project success, heuristic thinking to reduce effort becomes likely. Second, as William and Noyes (2007 p. 18) note, "[t]he level of trust in a system has the potential to influence people's decisions to act on the information they receive." And to project managers, the prescribed methods might lack credibility. However, heuristic thoughts and intuition appear trustworthy as they are often based on one's firsthand experiences. Thus, project managers are likely to trust their intuitions more than the outputs of the methods. Third, the output of most risk assessment tools is just numbers, and such numbers are "'dry statistics,' lacking the affect necessary to motivate proper action" (Slovic and Peters 2006, p. 325). In contrast, heuristic thoughts and intuitions can elicit negative affects or, as explained above, create gut feelings. Therefore, they provide a strong motivation for project managers to act. Fourth, the risk identification tools direct attention onto particular aspects of the environment and divert attention away from others. They thus create some blind spots in understanding the environment. A person's span of attention, however, might be generally broader than what is covered by a list. Therefore, managers might find the tools non-comprehensive and rely on their own perceptions. Finally, the objective methods might convey a false sense of precision (Pfleeger 2000), which is not the case with one's own assessments.

These kinds of issues have resulted in manifestation (I), which suggests that *IT project managers do not widely use the objective risk assessment methods*. It implies that risk assessment tools (e.g., checklists) are rarely used, for example only in the *pre* and initial project phases, if used at all.

We further note that the 'subjectivity' is not only in obtaining risk information, but also in processing it into an overall evaluation of risk exposure. Accordingly, manifestation (J) suggests that *IT project managers process risk information in a more holistic, experiential way than calculating according to a prescribed formula and in a quantitative fashion*. This is supported by the notion of heuristics in behavioral decision making literature (Kahneman and Fredrick 2002). Heuristic processing is fast and efficient. Additionally, it allows for handling complex situations through simultaneous inclusion of several pieces of information in an evaluation (Kahneman and Fredrick 2002). For example, it enables thinking about a range of probable undesired outcomes rather than just one salient undesired outcome, such as project failure (Barki et al. 2001).

Moreover, manifestation (K) states that *even when the objective risk assessment methods are used, their outputs have no or limited influence on the risk response decisions of IT project managers*. This is in accordance with the literature that suggests that one's perceived risk exposure is shaped by a variety of antecedents (Sitkin and Pablo 1992). Therefore, the use of risk assessment tools has partial or no influence on risk perception (e.g., Du et al. 2007) and risk response enactment, in some cases, becoming only an administrative duty (e.g., Kutsch and Hall 2005).

Finally, as an implication of the use of subjective methods such as heuristic thinking, the last manifestation (L) suggests that *IT project managers' identification of risk sources and evaluations of risk exposure are subject to biases*. The behavioral decision making literature suggests that an individual's judgments are prone to biases, i.e., patterns of systematic deviations from objective ones, e.g., those offered by impartial experts (Tversky and Kahneman 1974). This literature has identified several biases and their antecedents. For example, peoples' desire for self-enhancement is found to lead to the comparative optimism bias, defined as "the belief that one is at lower risk than other people for negative events" (Shepperd et al. 2002, p.1).

(c) Implications and research directions: Almost two decades ago, Lauer (1996) noted that software project risk management research

> neglects the judgement of risk on the part of the important actors who make up the software development project. Software projects involve sequences of judgements and choices on the part of, among others, the software project manager. [...] Therefore, in order to gain an understanding of software project risk, it is necessary to study risk judgements on the part of software project managers. *(p. 288)*

Yet our review reveals that there still is a paucity of research on how IT project managers identify risk sources and evaluate risk exposure. Given the alternative assumption, we believe that such studies would deepen our understanding of the current state of responding to risks in IT projects. Therefore, consistent with our problematization approach, we encourage further research by offering research questions from four themes.

Theme 1 – Increasing the Understanding of Subjective Risk Assessments

Understanding Heuristic Thinking and Intuition- Our review suggests that, except for few mentions (e.g., Ropponen 1999), research on heuristic thinking and intuition in IT project risk management is lacking. This is consistent with an observation in the general management literature stating that although the literature has acknowledged the use of intuitions (e.g., Akinci and Sadler-Smith 2012; Dane and Pratt 2007; Salas et al. 2010; Schwenk 1984), "management education and development has largely ignored or shied away from including intuition in its curriculum" (Sadler-Smith and Shefy 2007, p. 186). Therefore, to expand our understanding in this regard, the IT project risk management scholarly community can develop a richer knowledge set regarding the impacts of each form of heuristics on the perceived risk exposures, for instance, by asking:

RQ.1a: *When IT project managers assess risks, what are the salient heuristics they use? To what extent do these heuristics lead to a difference from an objective risk assessment?*

A recent review of prominent heuristics in the management context is provided by Akinci and Sadler-Smith (2012). In this paper, we specifically highlight the affect heuristic as an interesting avenue to be explored. More precisely, as part of assuming the identification of risk sources and evaluation of risk exposure to have an objective nature, our review revealed that the IT project risk management literature—as a whole—has assumed that risk management is devoid of emotions. In particular, in the management context, one might argue that "[a]lthough business people are not immune to swings in affective states, their experience and training may discount the impact of emotions on their decisions" (Dunegan et al. 1992, p. 337). This is consistent with the observation that most decision theories adopted to study risk behaviors are cognitive and assume feelings to be irrelevant (Loewenstein et al. 2001). However, feelings could be a relevant topic for risk management as risk is linked to negative affects (Slovic et al. 2007) and more specific emotions such as anxiety and dread (Slovic 1987). Indeed, management researchers have found that the valence of affect is relevant for decision making under risk in organizations (e.g., Mittal and Ross 1998).

Interested researchers may draw upon two streams of research. The first stream, the affect heuristic, suggests that people rely on their feelings in making decisions about risks

(Finucane et al. 2000; Slovic et al. 2007). The affect heuristic builds on the affect-as-information hypothesis (Schwarz and Clore 1983), which posits that the affective states related to the object of evaluation serve as informative inputs for decision making. The second stream suggests that the relationship between the feelings that occur at the time of evaluating the risk exposure—called anticipatory feelings—and the perception of risk is two-way and reinforcing (Loewenstein et al. 2001). From this view, for example, a project manager might be anxious and stressed when thinking about the undesired outcomes, and such feelings could intensify his or her perception of the risk exposure of such undesired outcomes.

Understanding Biases - Our review revealed few cognitive biases discussed in the IT project risk management literature. Nevertheless, given the project managers' reliance upon subjective risk assessments, investigating other biases is fruitful. Interested scholars can ask:

RQ.1b: *When IT project managers assess risks, what are the salient biases and their antecedents? To what extent do they lead to differences from objective evaluations of risk exposure?*

A list of salient biases is provided by Arnott (2006). Here, we specifically highlight personal relevance as an interesting but underexplored biasing antecedent. IT project managers are commonly assumed to be perfect agents for their organizations by not focusing on managing their personal risk. Nonetheless, for project managers, their reputation is on the line and the chances of being reassigned to future projects would depend on how well they manage their current projects (Fairly 1994). Therefore, their evaluations of risk exposure could be influenced by their personal relevance of risks.

Interested researchers may wish to examine the influence of personal relevance, for example, by comparing and contrasting stewardship theory (Davis et al. 1997) and agency theory (Alchian and Demsetz 1972; Eisnehardt 1989). Stewardship theory "defines situations in which managers are not motivated by individual goals, but rather are stewards whose motives are aligned with the objectives of their principals" (Davis et al. 1997, p. 21). It thus implies that IT project managers do not incorporate their personal wellbeing into their view of and response to risks. Alternatively, the moral hazard problem described by agency theory describes situations in which agents (who work for their principals) maximize their self-interest but not that of their principals. This view is consistent with the argument that managerial risk-taking behavior depends on "whose resources are being risked" (March and Shapira 1992, p. 172), with a tendency to risk organizational resources more than one's own. In this vein, Williams and Voon (1999) state that "another dimension of risk is the extent to which the decision maker is personally affected by risky decisions because risk aversion has been found to increase as risk-related outcomes become more personal in nature" (p. 270). From this point of view, IT project managers could be considered to take into account their personal risk besides that of their organization. They might attach importance to project objectives based on criteria by which their performance is evaluated (e.g., delivering on-time) as well as the personal consequences of deviating from these objectives. For example, when a manager is appraised by project delivery times, the risk exposure of risk sources that would lead to going over time may be more strongly evaluated than others.

Understanding the Preference for Using Subjective Methods instead of Objective Ones: In the theoretical explanation of the alternative assumption above, we sufficed to discuss briefly some determinants of depending on subjective methods instead of objective ones. Future studies may wish to expand this discussion and consider other determinants. Researchers may wish to ask:

RQ.1c: *Whether and when do IT project managers change their perceived risk exposure based on the results of objective risk assessments?*

Here we suggest the role of experience, project management training, and the existence of risk management infrastructure to be further explored. First, experience (e.g., age, the number of years of experience, and the number of projects managed) expands one's subjective sample. As Huff and Prybutok (2008) state,

> The knowledge gained from similar prior experiences helps the decision maker to make estimates for needed information left by gaps in available information, and also provides the individual with reasons and resources to make connections between data items that may appear to be disparate and unrelated to the decision. (p. 36)

Therefore, an experienced IT project manager may build a high level of trust in his or her ability to assess risks. For example, in a prototyping context, Baskerville and Stage (1996) found that in ranking the probability of a risk factor, "the team preferred to rely on its own experience" (p. 497). In contrast, risk management training (e.g., as part of project management training provided by PMI) encourages project managers to trust method-driven information. Therefore, examining such tensions between experience and training would be interesting.

Moreover, the existence of a risk management infrastructure (e.g., risk archive and risk evaluation tools) that has been used and proven to be helpful can reduce the required effort for using methods (Carr 1997). It can also increase the level of trust in using them. Interested researchers can investigate the extent to which the existence of an established risk management infrastructure in an organization increases the level of trust and facilitates the use of risk identification and risk exposure evaluation methods.

Theme 2 – Determining the Extent of Influence of Subjective Risk Assessments on Project Success

Relative Performance of Heuristic Thinking and Objective Risk Assessment Methods: Given that decision making based on heuristic thinking and intuition opens the way to various biases, the literature—as a whole—has assumed it to be an undesirable practice that should be avoided. Yet, as we discussed above, some IT project managers think that there are issues with objective risk assessment methods and that by drawing upon their experience, they can make better decisions. The advantages of intuition are illustrated in the infamous Taurus project (Drummond 1996). In this project, while the formal risk analyses were satisfactory, managers had a bad gut feeling. Yet "[t]o have intervened to stop the project on the basis of 'gut feel' would have been unthinkable" (Drummond 1996, p.354). The project was continued until it failed, making the managers regret that they did not trust their intuition. Therefore, an interesting avenue for future research would be to explore the influence of subjective assessments on project success. Project success, nevertheless, can be conceptualized in different ways (de Bakker et al. 2010). While it "is traditionally measured by time, budget, and requirements criteria," some researchers have viewed project success from the perspective of various project stakeholders (de Bakker et al. 2010, p. 495). This difference in the conceptualization of project success can lead to differing effects from perceived risk exposure. Therefore, in order to compare the usefulness of different conceptualizations of perceived risk exposure, project success should be conceptualized first. Then, one can explore:

RQ.1d: *When the objective evaluation of risk exposure differs from the perceived risk exposure, acting upon which one is more conducive to project success? Under what circumstances?*

To continue this line of inquiry, one can start with the work of Dane and Pratt (2007), who have examined an array of determinants of the effectiveness of intuitive managerial decision making. In this paper, we particularly suggest considering the advantages of heuristic thinking and intuition under complex situations. More precisely, most risk management methods were created using simplifications of the real world (Lyytinen et al. 1996); however, these simplifications may undermine the validity of their outputs when the situation is uncertain or complex. Heuristic thinking, nevertheless, is successful in rapidly estimating risks and in processing multiple data items under complex situations (Kahneman and Fredrick 2005). A recent neuroscientific study found that "normative strategies for decisions under risk do not generalize to uncertain worlds, where simple heuristics are often the more accurate strategies" (Volz and Gigerenzer 2012, p.1). Similarly in IT, Huff and Prybutok (2008, p.35) cite Abdolmohammadi and Wright (1987) and suggest that "experience is most beneficial when performing tasks that are poorly structured and complex." Thus in a complex, uncertain world, acting upon heuristic thoughts might be more advantageous than relying on objective methods that are based on several simplifying assumptions.

Theme 3- Encouraging Project Managers to Depend on Objective Methods

Discouraging Acting upon Subjective Risk Assessments: If following the normative route is more conducive to success than the subjective one, future normative research should examine the ways in which project managers could be kept from deciding upon subjective judgements. Therefore, interested researchers can investigate:

RQ.1e: *When deciding upon enacting risk responses, whether and how could IT project managers be discouraged from relying on their subjective judgments?*

This could be done, for example, through focused risk management training, governance, and method design. A starting point is to increase the IT project managers' awareness of how the heuristics work and the downsides of deciding based on them. With a key focus on educating project managers with what the project risk management prescriptions are (as in PMBoK 2013), less has been said about how to prevent them from relying on subjective judgments. Here the guidelines for developing intuitive awareness developed by Sadler-Smith and Shefy (2004) could be used. For example, using these guidelines, an experiment could be designed to make subjects aware of how they rely upon heuristics; and then whether their reliance on methods has increased in comparison to a control group could be verified.

Similarly, another underexplored research avenue is to design project management governance mechanisms that can better enforce and monitor decision making according to objective methods of identifying risk sources and evaluating risk exposure. Interested researchers can review an existing governance mechanism and, from it, examine whether decision making based on objective methods could be incentivized. Then, for example, action research could be conducted to see if the designed incentives were effective.

Moreover, if objective risk assessments are important but do not appear trustworthy and easy to use, the learnings from heuristics mechanisms can be used to redesign them. Interested researchers can explore whether and how the output format of risk assessment tools could be redesigned to make the results more believable and able to motivate action. For example, most of the current risk assessment tools provide only 'dry statistics'. Yet from the learnings about how heuristics are able to appear trustworthy and elicit feelings, risk assessment tools could be redesigned. One could build upon the recent work by Taylor et al. (2012), who redesigned a risk assessment tool to be more visual and, thus, practical. Their ideas could be extended by designing risk assessment tools that provide a vignette, e.g., a short true story that induces a mental image of how a similar project in the organization was challenged because of a similar risk factor.

Theme 4 – Leveraging Subjective Risk Assessments

Designing Hybrid Subjective/Objective Risk Assessment Approaches- Given that subjective risk assessments might be beneficial in addition to objective methods, it would be fruitful to know how to accrue the benefits of both worlds.

RQ.1f: *How can the potential power of heuristic thinking and intuition be better incorporated in risk assessment prescriptions?*

One such study would be to create more practical hybrid approaches, where the role of tools shifts from the main source of risk information to a validation for what people collectively think. As Carr (1997) discovered, "for the most part risk identification and analysis is performed on an ad hoc basis, generally at the beginning of the project through a brainstorming session by senior engineers" (p. 24). Instead of replacing such an intuitive process, it could be enriched and validated with objective risk assessment methods. To do so, one could build on the work of Baskerville and Stage (1996), who suggest using tools to structure intuitive thoughts:

> Risk analysis […] enables collaborative expression of a subjective evaluation of the situation. With this in mind, risk analysis should begin with an unstructured, brain-storming group session with the objective of formulating the initial risk inventory. Extensive, universal lists should be avoided at this early stage, since they can interfere with the creative process. However, once the team has exhausted their intuition, such checklists are helpful in structuring the discovery of a final formulation of risks that is very complete. (p. 486)

Improving Subjective Risk Assessments: If these subjective risk assessments could be beneficial under certain circumstances, further research might focus on how to improve them, especially for inexperienced IT project managers. Researchers could address:

RQ.1g: *Whether and how subjective risk assessments of IT project managers can be improved in the short term?*

Two starting points are calibrating heuristic thinking and debiasing. First, heuristics are suggested to be part instinct (Shah and Oppenheimer 2008) and part learned experiences and expertise (Jørgensen 2004; Simon 1987); thus, they are partly programmed during one's past experiences. In the software estimation context, Jørgensen (2004) has suggested that "[i]ntuition and judgment—at least good judgment—are simply analyses frozen into habit and into the capacity for rapid response through recognition" (p. 37). If this is the case, it would be feasible to accelerate the learning of heuristics and improve their accuracy. For example, the availability heuristic refers to people's reliance on the accessibility of memories in making judgments about risks (Tversky and Kahneman 1974). Such accessibility is dependent on the vividness of the remembered mental images (Slovic et al. 2007). Two ways of increasing the accessibility of mental images are feasible. Illustrative material, such as case studies and multimedia, could be used in designing risk assessment tools to induce such vividness for a mental image of a risk event that is not actually experienced firsthand. In doing so, risk events could be drawn from the top-10 lists of risk factors in IT projects (e.g., Boehm 1991). Moreover, project managers can be encouraged to share more of their experiences with their peers. As Taylor (2005) found, although postmortem project reviews are common, they are often "intended for a senior executive audience, rather than to spread information about the experience gained among other project management staff within the firm" (p. 440).

Additionally, a dysfunctional aspect of the subjective assessment of risk is biases; therefore, attempts on debiasing would probably be fruitful. Yet the literature is equivocal on whether debiasing is feasible. While some researchers argue that the influence of biases, being unconscious, could not be mitigated, others suggest that such mitigation is possible by increasing self-awareness (Arnott 2006). Interested researchers could examine whether and how IT project managers' risk assessment could be debiased. For example, one could design an experiment based on the work of Arnott (2006), who adopts a design science stance and suggests a four-step approach for debiasing through increased self-awareness:

> [1] Identify the existence and nature of the potential bias. [2] Identify the likely impact and the magnitude of the bias. [3] Consider alternative means for reducing or eliminating the bias. [4] Reassure the user that the presence of biases is not a criticism of their cognitive abilities. (p. 65)

What is clear is that to conduct this kind of research, a profound understanding of the biases (as suggested under Theme 1) is first required.

2.3.2 Decision-making Concept 2: The Relative Importance of Probability and Magnitude Dimensions of Risk Exposure

Risk exposure has often been conceptualized using two dimensions: magnitude of impact of an undesired outcome and its probability of occurrence (e.g., Boehm 1991; Du et al. 2007). The second area of difference focuses on the relative importance of these two dimensions in evaluating the risk exposure that is used for decision making about responses.

(a) Normative assumption: *In evaluating risk exposure, the probability of undesired outcomes is an important dimension.*

Because one of the primary reasons for assessing project risk exposure is to decide upon whether or not to enact risk responses, this conceptual assumption implies that IT project managers should consider the probability of undesired outcomes to be at least as important as the magnitude of loss if these outcomes occur, notwithstanding whether they would personally consider probability to be important.

Support for this assumption can be drawn from classical models of decision making such as PT/EUT, which view risk as a probabilistic concept. For example, expected value in PT equals the amount of an outcome weighted by its probability of occurrence. Likewise, expected utility in EUT corresponds to the utility of the outcome of a decision alternative weighted by its probability of occurrence.

Our review revealed that this assumption has manifested itself in the literature in two ways (see Table 2.4). The first manifestation (A) suggests that in evaluating risk exposure, the *magnitude and probability of undesired outcomes dimensions are equally important*. This comes from a direct adaptation of PT/EUT, as adopting each of these theories means assuming equal weights for probability and magnitude of loss dimensions. This manifestation implies that IT project managers should devote equal attention to all undesired outcomes that have equal PT/EUT-based risk exposure, notwithstanding the respective value of probability or loss for any given undesired outcome.

The second manifestation (B) suggest that *in evaluating risk exposure, only the probability of undesired outcomes is important*. As explained in the previous section, approximation is a common prescribed way for evaluating risk exposure. At the project level, often the extent to which a project is exposed to risk is estimated using the extent to which risk sources are present. Articles with this manifestation develop or adopt a list of risk sources and either count the number of present risk sources as on a checklist (e.g., Keil et al. 2008) or combine the strength of various risk sources in a formative fashion as in a risk instrument (e.g., Wallace et al. 2004a), without a reference to the magnitudes of their impact.

Table 2.4 Decision-making Concept 2: The Relative Importance of Probability and Magnitude Dimensions of Risk Exposure

<table>
<tr><td colspan="2">Normative: In evaluating risk exposure, the probability of undesired outcome is an important dimension.</td><td>Statistics: Manifestations found in 38 of 49 relevant articles.</td></tr>
<tr><td>Manifestations of The Assumption</td><td># of Codes</td><td>Sample Excerpt/ Interpretation</td></tr>
<tr><td>[A] In evaluating risk exposure, the magnitude and probability of undesired outcomes dimensions are equally important.</td><td>13</td><td>(Barki et al. 1993, p. 206) “Software development risk [exposure] = (project uncertainty) * (magnitude of potential loss due to project failure)”
(Heemstra and Kusters 1996, p. 334) “loss expectation. This can be expressed as the product of the risk impact multiplied by the probability and is referred to as the risk exposure. It indicates that when looking at risks the combination of both aspects (probability as well as impact) will have to be take into account.”</td></tr>
<tr><td>[B] In evaluating risk exposure, only the probability of undesired outcomes is important.</td><td>15</td><td>(Wallace et al. 2004a, p. 307) “This research focused only on the uncertainty, or risk factors, and did not address any additional impact caused by the size of possible losses due to failure.”
(Keil et al. 2008, p. 914) “number of risks identified” [considering the higher number of risks checked in a checklist to mean a riskier project]</td></tr>
<tr><td colspan="2">Behavioral: For IT project managers, the magnitude of loss due to an undesired outcome has more weight than its probability of occurrence.</td><td>Statistics: Manifestations found in 14 of 49 relevant articles.</td></tr>
<tr><td>Manifestations of The Assumption</td><td># of Codes</td><td>Sample Excerpt/ Interpretation</td></tr>
<tr><td>[C] For IT project managers, the magnitude of undesired outcomes is more important than their probability, although probability matters too.</td><td>6</td><td>(Keil et al. 2000a, p. 149) “H1: Magnitude of potential loss will have a greater impact than the probability of a loss occurring on risk perception.” [Supported]
(Baccarini et al. 2004, p. 289) “Research shows that the severity of the potential consequences of a risk produces a greater concern than its probability in evaluating the overall level of risk... For example, a low-probability/high-consequence risk is typically considered as being higher than a high-probability/low-consequence risk.”</td></tr>
<tr><td>[D] For IT project managers, only the magnitude of undesired outcomes is important.</td><td>3</td><td>(Schmidt et al. 2001, p. 26) “our panelists appeared to evaluate the magnitude of potential loss due to a risk, without regard to the probability of the risk actually having an effect on their project.”
(Taylor 2005, p. 441) “while respondents described an implicit assessment of the importance of risk, they typically paid little or no attention to the likely probability of the occurrence of the risk event.”</td></tr>
<tr><td>[E] IT project managers believe that the probability of undesired outcomes is difficult (or impossible) to estimate.</td><td>6</td><td>(Taylor 2006, p. 62) “one difficulty lies, not in identifying the risks, but in quantifying them, and particularly in determining their likelihood of occurrence.”
(de Bakker et al. 2010, p. 500) “A reason why quantitative risk analysis is not considered useful may be that many of the risks in IT projects are not aleatoric in nature (they are not based on probability), but epistemic, which means that there is not enough information available to take a decision.”</td></tr>
</table>

[F] IT project managers have difficulties in estimating risk factors, which are used to approximate the probabilities of undesired outcomes.	2	(Taylor et al. 2012, p. 19) "In reality, IT project managers face considerable uncertainty in determining the likely extent of any risk factor identified as a potential threat, and, therefore, uncertainty about possible solutions, in terms of their cost and effectiveness" (Sherer and Alter 2004, p. 42) "This article shows that the IS risk literature produced several hundred risk factors and many overlapping risk components that are difficult for managers to access and use in a meaningful way."

(b) Alternative assumption: *For IT project managers, the magnitude of loss due to an undesired outcome is more important than its probability of occurrence.*

Because one of the primary reasons for assessing project risk exposure is to select risk responses, this assumption implies that, considering two undesired outcomes with equal PT/EUT-based risk exposure, IT project managers will devote more attention to those outcomes that have higher loss values.

The theoretical explanation for this assumption can be drawn from the evaluability principle, put forth from a behavioral decision-making perspective (Hsee 1996). The evaluability principle has been used to explain that decision makers will pay uneven attention to the probability of an undesired outcome and the loss associated with its occurrence (Slovic et al. 2007). It suggests that an individual's perception of a stimulus is related to the extent of evaluability of the stimulus, which is defined as the extent and speed at which the stimulus can evoke an affect in the individual. Moreover, if a stimulus has multiple attributes, their relative weight in this perception is determined by their extent of evaluability (Slovic et al. 2007). Leveraging this idea, Slovic et al. found that the extent of evaluability of the two dimensions of risk exposure varied across contexts. For example, they suggested that in perceiving the risk of simple gambles with no loss, probabilities are easier to evaluate and thus have more importance than payoffs in decision making (the proportion dominance effect); however, in perceiving the risk of an airplane crash, the severity of the outcome clearly elicits a negative affect and becomes more important than the probability of the crash (the probability insensitivity effect). In the general management context, probability is found to be less evaluable than magnitude:

> [...] for these managers [in Shapira 1986], risk is not primarily a probability concept. About half (54%) of the managers [...] saw uncertainty as a factor in risk, but the magnitudes of possible bad outcomes seemed more salient to them. A majority felt that risk could better be defined in terms of amount to lose (or

> expected to be lost) than in terms of moments of the outcome distribution. (March and Shapira 1987, p. 1407)

This assumption is suitable to the IT project risk management context given the high impacts of IT project failure on organizations (Bloch et al. 2012; Charette 2005). Indeed, the magnitude of loss associated with undesired outcomes such as budget overruns and late deliveries is likely to elicit a highly negative affect and, according to the evaluability principle, become more important than the probability of occurrence.

Our review revealed different manifestations of this assumption. The first manifestation (C) suggests that *for IT project managers, the magnitude of undesired outcomes is more important than their probability, although probability also matters*. It implies that IT project managers are more sensitive to the magnitudes rather than the probabilities of undesired project outcomes (e.g., Pablo 1999). Pushing this idea to its extreme, manifestation (D) suggests that f*or IT project managers, only the magnitude of undesired outcomes matters.* It implies using only the magnitude dimension in defining and measuring risk exposure (e.g., as discussed in Bannerman 2008). Next, manifestation (E) pertains to the reasons why probability is less evaluable than magnitude in this context and suggests that *IT project managers believe that the probability of undesired outcomes is difficult (or impossible) to estimate*. Here, the explanation provided by the evaluability principle is reinforced by arguments regarding the credibility that IT project managers give to probability estimates in this context (Pfleeger 2000). The final manifestation (F) suggests that *IT project managers have difficulties in estimating risk factors, which are used to approximate probabilities of undesired outcomes*. This implies that even the methods that indirectly measure the probability dimension by approximating it may not be credible to project managers.

(c) Implications and directions for future research: Given the alternative assumption, the study of IT project managers' perceived risk exposure would appear to offer some promise regarding our understanding of project managers' risk responses. Considering the existence of several mentions of the alternative assumption but the scarcity of exploring its implications, we call for studies pertaining to four themes.

Theme 1 – Increasing the Understanding of Perceived Risk Exposure

Conceptualizing Perceived Risk Exposure as a Multidimensional Construct: Arising from the alternative assumption is a need for a definition of perceived risk exposure that focuses more on the magnitude dimension. Our review reveals few studies that have conceptualized IT project managers' risk perception based on both probability of occurrence of undesired outcomes and associated loss (Du et al. 2007; Keil et al. 2000a). Keil et al. (2000a) found a stronger effect from the provided information about magnitude of loss than from probability of undesired outcomes on risk perception; yet in measuring perceived risk, they combine both dimensions within the same items, thus their measure of perceived risk exposure does not allow considering different weights. Moreover, Du et al. (2007) refer to perceived risk exposure as "the belief that there exist sources of risk with potential to adversely affect project outcomes" and suggest that "[r]isk perception at the project level may reflect both the likelihood of various risks occurring and the extent to which they could materially impact project outcomes" (p. 272). But again in their measurement, they do not differentiate between these dimensions. Therefore, neither of these definitions considers higher importance for the magnitude dimension. In order to provide a more accurate understanding of IT project managers' perceived risk exposure, researchers can ask:

RQ.2a: *How can one capture both dimensions of perceived risk exposure but give more weight to magnitude than probability?*

To begin, we note that perceived risk exposure is a multidimensional construct; therefore, at least two ways of conceptualizing it are feasible (Law et al. 1998). First, perceived risk can be modeled as a multiplicative multidimensional construct (Law et al. 1998). In doing so, a power for the magnitude dimension can be considered before multiplying it with the probability. More precisely, instead of seeing perceived risk as $magnitude \times probability$, one could model it as $(magnitude)^n \times probability$, where n is greater than 1. Moreover, perceived risk can be modeled as a latent multidimensional construct (Law et al. 1998); that is, a second-order construct. Magnitude and probability become two dimensions that separately influence one's perceived risk exposure and different weights for them could be determined. This is similar to the approach taken by Keil et al. (2000a) with the difference that the dimensions are modeled as second-order factors of the same construct but not its antecedents.

In either conceptualization of perceived risk, further empirical studies are required to calibrate the relative importance of magnitude and probability—i.e., the power n in case of a multiplicative construct or the relative weights in case of a second-order factor construct, perhaps for different risk sources and in different contexts. One such study would be to conduct NeuroIS research to see how each dimension contributes to an IT project manager's perceived risk. More precisely, there are basically two ways to capture perception of risk in NeuroIS. The first is the use of electroencephalography (EEG), which captures the change in skin conductance due to perceiving risk (Vance et al. 2014). The second is the use of functional Magnetic Resonance Imaging (fMRI), which can capture activation of different feelings in one's brain. As discussed by Slovic (1987), the perception of risk is related to feelings of dread, fear, anxiety and similar emotions (Slovic 1987). Using fMRI helps identifying such emotions and, thus, the perception of risk (Mohr et al. 2010). From the findings of such studies, the existing definitions of perceived risk exposure could be updated.

Theme 2 – Identifying Which View of Risk Exposure Is Most Influential on Success

Explaining Project Success: Given the differences between a perceived risk exposure and a PT/EUT-based one, it is fruitful to know which is more useful for IT projects. This does not mean, however, that we are seeking a "true" risk exposure construct. As Barki (2008) states, to examine different definitions of a construct such as risk, "a more effective strategy would be to assess a construct's efficacy in predicting or explaining interesting or important phenomena. In a sense, this would be akin to assessing the construct's contribution to existing knowledge and theory" (p. 10). Therefore, it is the effect and contribution of different conceptualizations that is interesting but not their truthfulness. The difference in the conceptualizations of risk exposure could explain part of the observed difference between the enacted risk responses and the prescribed ones (Taylor 2005). Therefore, a useful research path is to address the extent to which each of these views contributes to the enactment of risk responses. Interested researchers can ask:

RQ.2b: *What is the relative influence of PT/EUT-based risk exposure and IT project managers' perceived risk exposure on their decision to enact risk responses and, ultimately, on project success?*

Such studies could compare the impact of perceived risk exposure and PT/EUT-based risk exposure either at the aggregate project level on the decision to apply formal risk management practices in the project or at a more granular level on the decision to enact specific risk responses. Another useful research path would be to evaluate which way of capturing risk exposure leads to making risk response decisions that would lead to more successful projects. One can examine the model offered by Barki et al. (2001) by including the perceived risk exposure construct and comparing its effect on project success with that of the PT/EUT-based construct.

From the answer to the question, future research can be directed to the two orthogonal paths described below.

Theme 3: Encouraging Use of PT/EUT-based Risk Exposure

Shaping Attention to Probabilities: Given that probabilities of undesired outcomes are less evaluable for IT project managers, future research is required to identify ways to encourage these managers to mind the probabilities. This calls for theories for design and action (Gregor 2006) theories that address the question:

RQ.2c: *How can IT project managers be influenced so that they pay more attention to the probability of undesired outcomes?*

This question can be approached in at least four ways. First, the way information is provided is important, because "the provision of information about a risk must ensure that the appropriate level of risk is perceived, so that an appropriate risk assessment of the situation takes place resulting in an appropriate decision" (William and Noyes 2007, p. 20). According to William and Noyes, the format of a risk message could be changed, e.g. its wording or appearance, and the recipient's attention could be directed to different aspects of the message. A recent example of reframing risk messages through design in the IT context is the action research reported by Taylor et al. (2012), whose participants "experimented with different approaches for presenting their analysis, with a goal of finding a more visually impactful approach that would provide a synthesis of the holistic risk picture of the project" and designed a chart that "provides a visual representation of aggregate risk that is accessible and easy to discuss" (pp. 22-23).

One way future research can explore formats of the risk assessment results and examine their effects would be to direct more attention towards the probability dimension.

The second way would be to design more coherent methods, for example, those that not only provide the probability estimates but also include the extent of confidence (e.g., low/medium/high) in the provided estimates. Moreover, since more data-driven estimates of probabilities might be more believable, one useful way is to estimate the probabilities using larger datasets such as risk archives or case surveys.

Third, the credibility of risk assessments could be increased by providing a qualitative (or even fuzzy) estimate (e.g., low/medium/high) instead of precise numbers. For example, referring to the issues about probabilities, Bannerman (2008) states:

> A common response to this problem in software projects is to view risk more generally in terms of uncertainty and to assess it qualitatively. Risk factors are assessed and ranked against a categorical scale of relative values such as low, medium and high (or, more typically, a five-point Likert scale) on the two dimensions of risk: likelihood and impact. Under this approach, 'high-highs' attract the most attention in applying risk control strategies, subject to cost; moderate risks ('medium–mediums') might only be monitored to see if they change status; while 'low–lows' might be ignored. (p. 2120)

Fourth, researchers may wish to redesign future risk management training and governance. Given the assumption that IT project managers are not very sensitive to probabilities of undesired outcomes, it will be interesting to explore whether and how training shapes project managers' attention to probabilities. Moreover, specific governance mechanisms, to be exercised for example by project management offices (PMOs), could be designed to ensure that the estimates of risk that are acted upon in IT projects consider the role of probability.

Theme 4: Updating the Risk Management Prescription

Reconceptualizing the Risk Exposure Construct Used in the Normative Research: In case giving more weight to the magnitude dimension of risk exposure might be a better alternative for normative purposes, the notion of risk exposure used in developing prescriptions and tools could be reconceptualized accordingly. From this point of view, Keil et al. (2000a) state that

> risk assessment instruments will be most effective when they force managers to confront the magnitude of the potential loss associated with a course of action, rather than simply highlighting the elements that could contribute to the possibility of a failure. (p. 153)

Yet "a generally accepted definition of risk that is not based on the notion of probability has not yet emerged in the literature" (Bannerman 2008, p. 2120). Also, we are not aware of any such risk assessment tools. Therefore, an important research question is:

RQ.2d: *How can one update the conceptualization and measurement of risk exposure to assign greater importance for its magnitude dimension than its probability dimension?*

One area of study would be to use risk message reformatting (William and Noyes 2007) to design risk assessment tools that highlight the magnitude dimension of risk exposure. Another starting point could be to move away from overall project outcomes (i.e., project failure or deviations from three project outcomes of time, costs, and functionality) that are far from the risk sources and to focus on intermediary project outcomes that are closely tied to the risk sources. For example, for the risk source of a user's having a negative attitude towards the system being implemented, instead of project failure, the undesired outcome of user resistance could be considered. A risk assessment tool could be designed to highlight such intermediary events and their impacts—say in a qualitative fashion.

2.3.3 Decision-making Concept 3: The Determinants of Risk-response Decision

When risk sources with significant risk exposure are noticed, IT project managers should decide on whether to enact a risk response. The third area of difference focuses on the determinants of such a decision.

(a) Normative assumption: *The determinants of the decision of whether to enact a risk-response are the level of risk exposure and the risk-mitigation effects of the risk response.*

This contextual assumption implies that the level of risk exposure and the extent to which a corresponding risk-response affords risk-mitigation are the only factors that directly influence the decision to enact the risk response; therefore, IT project managers should decide on risk response enactment notwithstanding the other determinants (e.g., personal characteristics, project characteristics) that encourage or discourage enacting the responses.

This assumption stems from a control systems engineering adaptation of the feedback control theory (e.g., Doyle et al. 2009). As depicted in Figure 2.3, a basic closed-loop control model involves a system, a sensor, and a controller. The system output is constantly sensed and compared to a reference level, and when there is a measured error (i.e., when the measured output deviates from the reference level), the controller enacts an input to the system in order to bring the system output closer to the reference level. Underlying this model, therefore, is the contextual assumption that the determinants of enacting a system input by the controller are a measured error and the inherent ability of the enacted system input to bring the system output closer to the reference level. Other factors are assumed not to be influential on the controller's enactment of a system input.

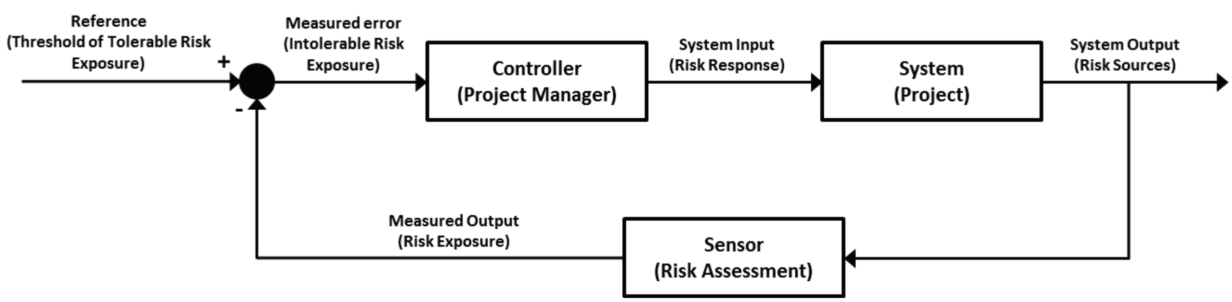

Figure 2.3 A Basic Closed-loop Control Model (Adapted from Doyle et al. 2009, p. 33)

Adapting this model to the IT project risk management context, the system is a project, the controller is a project manager, and the system inputs are the risk responses the manager enacts. Moreover, the system output is the risk exposure due to risk sources; the sensor is a way of risk assessment, i.e., identifying risk sources and evaluating their risk exposure; and the reference level is the threshold of tolerable level of risk exposure. According to this closed-loop model, IT project managers constantly identify risk sources and evaluate their risk exposure, compare the risk exposure with the threshold; and if there is an intolerable risk exposure, they will enact risk responses that have the effect of reducing the risk exposure. As such, the determinants of project managers' decisions to enact risk responses are the level of risk exposure and the risk-mitigation effects of risk responses. Consistent with this view, IT project management studies have looked at risk management as a process of constantly assessing and controlling risks (e.g., Boehm 1991). For example, Fan and Yu (2004, p. 193) develop their work on the basis of the rationale that "[r]isk management should be performed continuously in a feedback loop so that problematic situations can be dynamically detected and adjusted."

Reviewing the articles in our pool revealed multiple manifestations of this assumption (Table 2.5). Manifestation (A) explicitly indicates that the risk-response enactment decision *is based on the level of risk exposure and the risk-mitigation effect afforded by the risk response*. It implies that besides the presence of a risk source and the existence of a risk response, their extent influences the risk response enactment decision (e.g., Keil et al. 1998). Yet in some other articles, only the presence of a risk source and a corresponding risk response is considered but not their extent. The risk responses are considered to afford adequate risk-mitigation effect and the risk sources are considered to have significant risk exposure. Accordingly, manifestation (B) suggests that *the risk-response enactment decision comprises identifying and enacting a risk response action that corresponds to the identified risk source*. This could be performed, for example, by using a list of specific risk responses mapped over a list of specific risk sources (e.g., Boehm 1991). Moreover, in another connotation of the normative assumption, the existence of risk responses that afford adequate risk-mitigation effects is not a concern and the focus is on risk assessment, i.e., identifying risk sources and measuring the risk exposure. Accordingly, manifestation (C) suggests that *a knowledge of risk sources will result in enacting responses to them*. From this view, although risk management is deemed important, the focus is only on risk assessment, and a deep discussion of risk responses is lacking (e.g., Schmidt et al. 2001).

Table 2.5 Decision-making Concept 3: The Determinants of Risk-response Decision

Normative: The determinants of the decision of whether to enact a risk-response are the level of risk exposure and the risk-mitigation effects of the risk response.		**Statistics:** Manifestations found in 27 of 67 relevant articles.
Manifestations of the Assumption	# of Codes	**Sample Excerpt/ Interpretation**
[A] The risk-response enactment decision is based on the level of risk exposure and the risk-mitigation effect afforded by the risk response.	5	(Keil et al. 1998, p. 79) The two factors to consider in risk response decisions are the "perceived level of importance of the risk," which represents the level of risk exposure, and the "perceived level of control," which refers to "the degree to which the project managers perceived that their actions could prevent the risk from occurring" (Barki et al. 2001, p. 57) "These results suggest that a software project's Risk Management Profile needs to be adapted to its degree of Risk Exposure."
[B] The risk-response enactment decision comprises identifying and enacting a risk response action that corresponds to the identified risk sources.	13	(Boehm 1991, p. 38) "to develop a set of risk management plans that lay out the activities necessary to bring the risk items under control. One aid in doing this is the top-10 checklist in Figure 3 that identifies the most successful risk-management techniques for the most common risk items." (Baskerville and Stage 1996 p. 489) "In our action research project, we used the four classes of resolution strategies […]. Below, these resolution strategies are related to the risks and consequences discussed above."
[C] A knowledge of risk sources will result in enacting responses to them.	9	(Jiang et al. 2001, p. 47) "Risk-based management dictates that approaches to mitigate risks must be based on the risks present in the project […]. Essentially, this leads us to expect that behavioral approaches to managing risks will be employed if the risks are perceived to be behaviorally oriented. A similar expectation would apply to the technical risks." (Schmidt et al. 2001, p. 27) "proper risk assessment and the development of strategies to counter the risks requires an understanding of (1) what the actual risks are, (2) which of these risks managers perceive to be more deserving of their attention, and (3) how these risk perceptions differ from one culture to another."
Behavioral: IT project managers' decision of whether to enact a risk response involves determinants beyond the level of risk exposure and the risk-mitigation effects of the risk response.		**Statistics:** Manifestations found in 33 of 67 relevant articles.
Manifestations of the Assumption	# of Codes	**Sample Excerpt/ Interpretation**
[D] IT project managers' decision of whether to enact a risk response is influenced by their personal characteristics.	5	(Huff and Prybutok 2008, p. 37) "Low-risk-propensity individuals concerned more with the potential undesirable consequences of their decisions than the gains of potential success are internalizers." (Keil et al. 2000a, p. 147) "In addition to the framing effect, other research suggests that decision-making can be influenced by the nature of the task (Slovic, 1972), the subject's familiarity with the problem domain (Slovic et al. 1982), affect (Dunegan et al. 1992), and self-efficacy (Krueger and Dickson 1994). Most of the above factors presumably have an indirect effect on decision-making which are expressed through changes in risk perception."
[E] IT project managers consider enacting a risk response to have multiple—sometimes undesired—effects beyond risk mitigation.	13	(Boehm 1989, p. 4) [risk-reduction leverage (RRL) quantity is] "a measure of the relative cost-benefit ration of performing various candidate risk reduction activities" (Drummond 1996, p. 355) "although the inherent contradictions of management are unresolvable, a crucial element of competence is the awareness that prescriptions for action, like drugs, possess side effects. The art of management is knowing when control is creating chaos."
[F] IT project managers believe that it is difficult (or impossible) to demonstrate the risk mitigation effects of risk responses.	4	(Kutsch and Hall 2010, p. 251) "Resources are committed in advance to respond to risks that are not certain to occur but the client/owner or sponsor may be unwilling to spend money and energy on a management process without knowing it has definite benefits (Royer 2000)." (Kutsch and Hall 2010, pp. 251-252) "[p]roject managers are nonchalant about risk-related information because although the costs of taking actions to manage 'fictional' risk are immediately visible, the effect of threats that may or may not impact the project outcome is not."

[G] IT project managers are under pressure for or against enacting risk responses.	7	(Drummond 1996 p. 347) "Acceptance of risk, it is argued, is ultimately determined by the balance of power between decision makers. […] Analysis highlights the impact of politics upon the assumption of risk, and shows how power rather than technical rationality may be the ultimate arbiter in decision making." (de Bakker et al. 2010 p. 494) "With respect to the use of risk management in projects, professionals therefore state that risk management must be done because the project management handbooks say so, and it should be done in the way the handbooks prescribe it …"
[H] IT project managers consider the availability of knowledge and resources when deciding upon enacting risk responses.	9	(Bannerman 2008 p. 2122) "The literature describes generic options for responding to project risks […] Within these high-level options, specific responses can be formulated according to the circumstances of the project, the threat, the cost of the response and the resources required for the response." (Taylor 2005, p. 439) [for her respondents] "risk management was a costly luxury".
[I] IT project managers may have a preference for waiting and seeing what happens and then taking contingent actions if risks materialized than enacting risk responses.	9	(Taylor 2005, p. 441) "The risk response planning … focused almost exclusively on the addition of contingency to the proposed schedule and budget. This differs from the range of possible risk responses recommended in the literature, which includes taking pro-active actions to eliminate or reduce risks that have been identified" (Kutsch and Hall 2010, p. 251) "other stakeholders appear to wait until risk resolves itself (Yang et al. 2004) and to react to actual materialising risks."

(b) Alternative assumption:*IT project managers' decision of whether to enact a risk response involves determinants beyond the level of risk exposure and the risk-mitigation effects of the risk response.*

This assumption implies that IT project managers' risk response decision might not be consistent with their perceived risk exposure and the risk-mitigation effects of the risk responses because of the influence of other determinants.

Support for this assumption can be drawn from the behavioral decision theory literature (Slovic et al. 1997) and their applications to the managerial risk taking literature (e.g., March and Shapira 1987). These two bodies of literature, as a whole, discuss the influence of a variety of personal and contextual factors on decision making under risk.

Our review revealed various manifestations of the alternative assumption. The first manifestation (D) suggests *that IT project managers' decision of whether to enact a risk response is influenced by their personal characteristics*. In an integrative study on managerial risk taking, Sitkin and Pablo (1992) suggest that the antecedents of risk taking behavior are risk perception (i.e., subjective assessment of risk) and risk propensity (i.e., tendency to take or avoid risks). Given the focus of this model on risk taking behavior but not risk management, it is appropriate to study decisions that concern either taking or rejecting a risk. Examples of such decisions are project acceptance vs. rejection before it starts (e.g., Lauer 1996) or project continuation vs. cancellation (i.e., escalation or de-escalation) midway through the project (e.g., Keil et al. 2000a).

Moreover, adopting a consequentialist view of decision making, manifestation (E) states that *IT project managers consider enacting a risk response to have multiple—sometimes undesired—effects beyond risk mitigation*. Theoretically speaking, a direct application of PT/EUT to study risk response decision making leads to considering a distribution of outcomes for risk responses rather than one—risk mitigation—outcome. Such a distribution of outcomes, for example, could include the costs of enacting risk responses; and it has been considered in a few normative studies that calculate the expected utility for before and after enactment of risk response (Charette 1996b) or the risk-reduction leverage (RRL) quantity (Boehm 1989). However, as discussed above, the dominant normative assumption focuses on the risk-mitigation effects of risk responses; thus, it is not completely faithful to PT/EUT. From this manifestation, the range of outcomes that project managers consider for risk responses comprises immediate costs, such as the required effort, or potential side effects, such as creating anxiety in project stakeholders (e.g., Kutsch and Hall 2009). Emphasizing such immediate costs and potential side-effects for enacting risk responses, the next manifestation (F) suggests that *IT project managers believe that it is difficult (or impossible) to demonstrate the risk mitigation effects of risk responses*. Risk responses may involve investing time, effort, money, and other resources; however, demonstrating the benefits of such investments is difficult because it involves measuring the extent to which undesired outcomes did not materialize because of the enacted risk responses—something that might not necessarily happen (McGrew and Bilotta 2000). That is, the undesired outcomes might or might not materialize if the risk responses are not enacted, and their non-materialization might or might not be due to the enactment of risk responses.

In addition, manifestation (G) indicates that *IT project managers are under pressure for or against enacting risk responses*. Managers might be directly or indirectly influenced by their top management; their past education, such as project management certification training; the project management methodologies they follow; or by the actions of their role models, such as their successful peers. Another manifestation (H) suggests that *IT* *project managers consider the availability of knowledge and resources when deciding upon enacting risk responses*. From this view, enacting risk responses requires having the authority, knowledge, and the resources required to do so. Therefore, even if the costs of risk responses are justified but the resources to enact them are not available, they will not be enacted.

As an implication of considering the multiple antecedents for a risk response decision, including costs, side effects, negative pressures, and lack of the required resources, the final manifestation (I) suggests that *IT project managers may have a preference for waiting and seeing what happens and then take contingent actions if risks materialized than for enacting risk responses*. This means when IT project managers perceive risks, they sometimes either delay decisions and or decide to take no action (e.g., Kutsch and Hall 2005) or enact actions different in nature from the risk responses prescribed in the literature (e.g., Taylor 2005).

(c) Implications and directions for future research: Given the alternative assumption, and the relative lack of empirical research on the risk response determinants, further studies are required under four themes.

Theme 1 – Increasing the Understanding of the Determinants of Risk Response

Conceptualizing Risk Response as Planned Behavior: The literature has offered some reasons for not applying specific risk responses or risk management practices. Regarding specific risk responses, Bannerman (2008, p. 2122) suggests that "specific responses can be formulated according to the circumstances of the project, the threat, the cost of the response and the resources required for the response." Likewise, focusing on the decision to apply formal risk management practices, Kutsch et al. (2012) found that "the choice of disengagement from managing risks is driven predominantly by five beliefs: legitimacy, value, competence, fact and authority" that are held by project managers (p. 7). Building on these studies, one can ask:

RQ.3a: *What are the determinants of IT project managers' decision to enact—or not—risk management?*

While this question can be answered for either enacting specific risk responses or risk management process, here we focus on the former. As a first step, and in order to benefit from adapting an established theory to this context, specific risk responses can be conceptualized as planned behaviors of IT project managers. Therefore, they could be studied using the reasoned action approach (Fishbein and Ajzen 2010), including the theory of planned behavior (Ajzen 1991). From this theory, the direct antecedents of a behavior are a behavioral attitude (i.e., a subjective aggregation of the costs and benefits of performing the behavior), a perceived pressure (i.e., a subjective aggregation of the pressures for or against performing the behavior), and a perceived control (i.e., a subjective assessment of the facilitators or inhibitors of performing the behavior in terms of resources and knowledge). From this approach, other factors, such as risk propensity, are background factors that, thus, influence the intention to perform the behavior via the three direct antecedents of behavioral intention. Interested researchers could design and run a survey and identify which antecedent is the most influential on the risk-response decision of IT project managers.

Perceived Disadvantages of Enacting Risk Responses: The extant literature (e.g., Kutsch and Hall 2012) has explored the undesired outcomes associated with applying formal risk management practices, but not those ensuing from specific risk responses. Such knowledge is required to have a nuanced understanding of what kinds of costs prevent IT project managers from enacting specific risk responses. Therefore, an open avenue for future research is to explore:

RQ.3b: *For each key risk response in IT projects, what are the salient costs and side effects?*

To begin, researchers may wish to identify key risk responses in IT projects (e.g., Barki et al. 2001) and then try to find out if any negative outcomes are perceived to be associated with these activities. Deductively, they can review the literature to find the potential negative outcomes of each top risk response. Inductively, they can conduct the belief elicitation procedure (Fishbein and Ajzen 2010) to identify the advantages and disadvantages of each top risk response.

Moreover, it would be promising to know how project managers would see the advantages of risk responses in light of the costs associated with them. This is important because, one could excessively perform risk management in general and unnecessarily engage in risk responses in particular. Regarding the risk management processes, Ropponen and Lyytinen (1997) state:

> Another finding is that a moderate allocation of resources (2-8% of the project's time) to manage risks can help considerably to maintain a stable and correct resource allocation, and to manage complexity. […] Our analysis reveals, however, that too little risk management (less than 2%) or too much (over 8%) can result in a considerably lower performance. (p. 44)

A starting point is to build on prospect theory (Kahneman and Tversky 1979), which suggests that people in a loss context (here a project with many problems) would seek risks (here by not responding to perceived risks) in hope of a gain (here in hope that the undesired outcomes do not occur). On the basis of the costs and benefits identified for each risk response and the understanding of how they are counterbalanced, a threshold for overdoing the response could be identified. One such study would be to examine how much risk management is too much risk management and, then, to design experiments to confirm what was learned.

Conceptualizing a Risk-Response/Contingency Propensity Construct: While some project managers prefer to wait and see what happens, others prefer to take responsive actions. These individuals' tendencies can significantly influence their behavior. This tendency is conceptually close to the notion of risk propensity; yet it is different because the focus is on engaging in extra activities to confine risks, not just to avoid risks. Interested researchers can ask:

RQ.3c: *Do IT project managers have a long-lasting—but context dependent—propensity to take risk response actions or make risk contingency plans?*

With a view to enacting risk responses rather than risk taking behavior, we believe that the tendency either to take preventive actions or to wait and see what happens and then deal with the problems as they arise can be conceptualized as a propensity construct. A starting point is to note the conceptualizations of the risk propensity construct (McCrimmon and Wehrung 1986; Sitkin and Pablo 1992). Moreover, the correlation between such a risk-response/contingent action propensity construct and the risk propensity construct will be interesting to explore as well.

Theme 2 – Which Determinants Can Be Considered to Increase Project Success?

Explaining Risk Response Decisions and Project Success: Considering the risk-increasing effects of risk responses can influence the way risk response enactment decisions are made and, ultimately, project success. While one idea is that risks should be mitigated at any cost and under any pressure, there might be sense in what some project managers do, which is not to enact risk responses in face of costs, pressures, and lack of resources. Therefore, given a specific conceptualization of project success (de Bakker 2010), researchers can address the question:

RQ.3d: *In deciding on whether to enact a risk response, which approach is most conducive to project success: deciding only upon the level of risk exposure and risk mitigation effects of the response, or considering the other factors?*

Researchers can begin with the notion of risk-reduction leverage (Boehm 1989). A model comparing the effect of RRL and the risk-mitigation effect of the responses can be developed to examine which one is a better correlate of project success.

On the basis of the answer to this question, future research can be directed towards Theme 3 or Theme 4.

Theme 3 – Encouraging Project Managers to Respond to the Identified Risks

Motivating Enacting More Risk Responses via Governance: Future risk management training can focus on encouraging managers to invest more in risk response actions. From this perspective, if there is a significant risk, project managers can try their best to take the corresponding risk response action, accepting the immediate costs and potential side effects of the response. In this context, IT project managers can be advised that although risk response might add to the short-term costs, these costs are often justified, considering the impact of the risks that can materialize. To further explore this avenue, one can ask:

RQ.3e: *How can one encourage IT project managers not to overstress the costs, negative pressures, and lack of resources in their decisions on whether to enact risk responses?*

One such study would be to examine ways to build an organizational culture and a risk management infrastructure that supports risk management (Carr 1997). Particular resources, such as project-portfolio-level slacks, could be offered for managing risk. More authority for enacting risk responses could be delegated to project managers. Researchers can also design governance mechanisms to be enforced by PMOs. Such governance mechanisms can monitor and incentivize enacting a response prescribed by a method when the corresponding risk source is sensed, for example, increasing user participation when users have a negative attitude towards the system being implemented. They can also discourage enacting risk responses that methods do not recommend, for example, spending time on requirement specification while the development approach is agile.

Theme 4 – Updating the Prescriptions to Consider More Determinants of Risk Responses

Considering the Dynamic Effects of Risk Responses: Enacting risk responses may mitigate the risk exposure of more than one risk source and at the same time may increase the exposure to some others. To help managers make more informed decisions, the risk-mitigation effects of the prescribed risk responses should be presented in parallel to their risk-increasing effects. Therefore, one might ask:

RQ.3f: *How could risk management methods be updated to consider the dynamic effects of risk responses?*

Future risk management methods can go beyond a simplistic one-to-one mapping of risk sources and responses and prescribe the choice of a risk response based on the multiple risk sources risk management deals with or creates. As a starting point, interested researchers can extend the extant efforts to pair specific risk responses and risk sources (e.g., Boehm 1991, Lyytinen et al. 1998; Addison and Vallabh 2002; Tesch et al. 2007) by including the costs and side effects of each risk response. This could be done deductively by conducting a literature review or inductively by asking project management experts, for example, using a Delphi study.

Paradigm Shift from Risk-response Planning to Contingency Planning: If there is a wisdom in the observed behavior of IT project managers that often involves dealing with problems as they arise rather than attempting to prevent them (Taylor 2005; Kutsch and Hall 2005), then future risk management research should focus more on contingency planning. Interested researchers can investigate:

RQ3.g: *What are the specific contingency plans for each specific risk source/undesired outcome in IT projects?*

To begin, researchers can take the top-10 list of risk sources (e.g., Keil et al. 1998) and identify what undesired outcomes could occur. Then, for each of these undesired outcomes, they can develop some contingency plans beyond dedicating some slack in budget and time. This could be done, for example, through Delphi studies of the experience of IT project managers.

2.4 Concluding Remarks

In this paper, we have reviewed the IT project risk management literature by adapting a problematization approach (Alvesson and Sandberg 2011) and applying it to a balanced sample of 72 highly-cited—behavioral and normative—articles conducted over the past 25 years. Our review revealed three fundamental decision-making concepts about which the assumptions behind the risk management prescriptions are different from the way IT project managers perceive and respond to risks. These concepts are: (1) the objectivity of risk assessment, (2) the relative importance of probability and magnitude dimensions of risk exposure, and (3) the determinants of risk-response decisions. We explored each area in depth by articulating the normative assumption, developing an alternative behavioral assumption, and offering a series of research questions pertaining to four major themes. These themes are (a) to increase our understanding of the actuality of risk perception and behavior in that area, (b) to examine whether a normative or a behavioral approach is more conducive to project success, and from that learning (c) to identify ways to encourage project managers—through governance or training—to better follow the normative prescriptions, or else (d) to update the existing risk management prescriptions to accommodate the behavioral insights. For each research question that we offered, we provided some justification and also some starting points for interested researchers. Our intention was not to be exhaustive; rather we aimed at generating examples of how behavioral aspects of decision making could be more deeply incorporated into IT project risk management research. Table 2.6 summarizes the assumptions and research questions.

This review has some limitations. First, we focused on the decision making of individuals, especially IT project managers. However, risk management could be seen as a collective-level activity in which each project stakeholder has an opinion about risks and responses and may try to exercise that opinion (Lim et al. 2011). While we suggest capturing the pressure from the key stakeholders on project managers as part of our discussion of Alternative Assumption 3, we believe that studying the group-level decision-making behavior could also be fruitful. Second, we used a subsample of articles and did not exhaust the literature for this review. Although we verified saturation by continuing until the new learning from the inclusion of additional articles became marginal, further research could explore the other articles in search for additional insights. Third, we used the extant evidence to demonstrate the deviation of risk perceptions and behaviors of IT project managers from normative research. This evidence, nevertheless, is limited and in some cases outdated. Given the increased intensity of project management training, further empirical evidence for the difference between normative and behavioral views on each fundamental concept would be fruitful. Fourth, as in any coding exercise, our articulation of the areas of difference, the manifestations, and the assumptions might be deemed subjective. To address this issue, we provided coherence, especially by extending the problematization and proceeding to the dialectical interrogation as a coding process. Nevertheless, other researchers might be able to articulate additional or even different underlying assumptions.

Table 2.6 Summary of the Developed Research Agenda

Decision-making Concept 1 The Objectivity of Risk Assessment			
Normative Assumption *A dependable risk assessment that can be acted upon has an objective nature.*		***Alternative Assumption*** *IT project managers do rely on subjective risk assessments when deciding upon whether or not to enact a risk response.*	
Theme	**Broad Research Objective**	**Sample Research Question**	**A Starting Point**
1 – Increasing the Understanding of Subjective Risk Assessments	Understanding Heuristic Thinking and Intuition	**RQ.1a:** When IT project managers assess risks, what are the salient heuristics they use? To what extent do these heuristics lead to a difference from an objective risk assessment?	Affect Heuristic
	Understanding Biases	**RQ.1b:** When IT project managers assess risks, what are the salient biases and their antecedents? To what extent do they lead to differences from objective evaluations of risk exposure?	Personal relevance
	Understanding the Preference for Using Subjective Methods instead of Objective Ones	**RQ.1c:** Whether and when do IT project managers change their perceived risk exposure based on the results of objective risk assessments?	
2- Determining the Extent of Influence of Subjective Risk Assessments on Project Success	Relative Performance of Heuristic Thinking and Objective Risk Assessment Methods	**RQ.1d:** When the objective evaluation of risk exposure differs from the perceived risk exposure, acting upon which one is more conducive to project success? Under what circumstances?	Complex Situations
3- Encouraging Project Managers to Depend on Objective Methods	Discouraging Acting upon Subjective Risk Assessments	**RQ.1e:** When assessing risks, whether and how could IT project managers be discouraged from relying on their subjective judgments?	Reformatting risk messages
4 – Leveraging Subjective Risk Assessments	Designing Hybrid Subjective/Objective Risk Assessment Approaches	**RQ.1f:** How can the potential power of heuristic thinking and intuition be better incorporated in risk assessment prescriptions?	Using objective methods to complement intuition
	Improving Subjective Risk Assessments	**RQ.1g:** Whether and how subjective risk assessments of IT project managers can be improved in the short term?	Calibrating heuristics, Debiasing
Decision-making Concept 2 The Relative Importance of Probability and Magnitude Dimensions of Risk Exposure			
Normative Assumption *In evaluating risk exposure, the probability of undesired outcome is an important concept.*		***Alternative Assumption*** *For IT project managers, the magnitude of loss due to an undesired outcome is more important than its probability of occurrence.*	
Theme	**Broad Research Objective**	**Sample Research Question**	**A Starting Point**
1 – Increasing the Understanding of Perceived Risk Exposure	Conceptualizing Perceived Risk Exposure as A Multidimensional Construct	**RQ.2a:** How can one capture both dimensions of perceived risk exposure but to give more weight to magnitude than probability?	Second-order factor conceptualization, non-linear conceptualization
2 – Identifying Which View of Risk Exposure	Explaining Project Success	**RQ.2b:** What is the relative influence of PT/EUT-based risk exposure and IT project managers' perceived risk exposure on their	Measuring the two constructs in the same study

is Most Influential on Success		decision to enact risk responses and, ultimately, on project success?	
3 - Encouraging Managers to Use the PT/EUT-based Risk Exposure	Shaping Attention To Probabilities	**RQ.2c:** How can one IT project managers be influenced so that they pay more attention to the probability of undesired outcomes?	Formatting the risk message
4: Updating the Prescription to Use the perceived risk exposure	Reconceptualizing the Risk Exposure Construct Used in the Normative Research	**RQ.2d:** How can one update the conceptualization and measurement of risk exposure to assign greater importance for its magnitude dimension than the probability dimension?	Designing tools that focus on intermediary project outcomes

Decision-making Concept 3
The Determinants of Risk-response Decision

Normative Assumption	***Alternative Assumption***
The determinants of the decision of whether to enact a risk-response are the level of risk exposure and the risk-mitigation effects of the risk response.	*IT project managers' decision of whether to enact a risk responses involves determinants beyond the level of risk exposure and the risk-mitigation effects of the risk response.*

Theme	Broad Research Objective	Sample Research Question	A Starting Point
1 – Increasing the Understanding of the Determinants of Risk Response	Antecedents of Risk Response Decision	**RQ.3a:** What are the determinants of IT project managers' decision to enact—or not—risk management?	Conceptualizing risk response as planned behavior
	Perceived Disadvantages of Risk Responses	**RQ.3b:** For each key risk response in IT projects, what are the salient costs and side effects?	Eliciting beliefs
	Risk Management Tendencies	**RQ.3c:** Do IT project managers have a long-lasting—but context dependent—propensity to take risk response actions or make risk contingency plans?	Conceptualizing a risk-response/ contingency propensity construct
2 – Which Determinants Can Be Considered to Increase Project Success?	Explaining Risk Response Decisions and Project Success	**RQ.3d:** In deciding on whether to enact a risk response, which approach is most conducive to project success: deciding only upon the level of risk exposure and risk mitigation effects of the response, or considering the other factors?	
3 – Encouraging Project Managers to Respond to the Identified Risks	Motivating Enacting More Risk Responses via Governance	**RQ.3e:** How can one encourage IT project managers to not overstress the costs, negative pressures, and lack of resources in their decision on whether to enact risk responses?	Characterizing a supportive organizational culture
4 – Updating the Prescriptions to Consider More Determinants of Risk Responses	Considering the Dynamic Effects of Risk Responses	**RQ.3f:** How could risk management methods be updated to consider the dynamic effects of risk responses?	Including risk-mitigating and risk-increasing effects
	Paradigm Shift from Risk-response Planning to Contingency Planning	**RQ3.g:** What are the specific contingency plans for each specific risk source/undesired outcome in IT projects?	Determining contingent actions for top-10 responses

Notwithstanding these limitations, our study makes a number of contributions. Our primary contributions are to the IT project risk management research. We first contribute to the ongoing discussion of the assumptions underlying risk management literature (e.g., de Bakker et al. 2010) by identifying the dominant normative assumptions, developing alternative assumptions, and discussing the research and practice implications of each assumption-level difference in depth. Moreover, by arguing that the dominant assumption about the determinants of risk response decision stems from feedback control theory rather than classical decision theories, we add to the understanding of this literature.

We also contribute to the offered IT project risk management research programs (e.g., Sauer et al. 2008) by calling for incorporating more of the behavioral phenomena of decision making into this stream of research. This call is motivated by our observation, consistent with that of Kutsch and Hall (2009) that there is "a substantial body of literature on what project managers *should* do, rather than on what they *did* do" (p. 78). In creating the pool of articles, we noticed that the normative studies that satisfied the exclusion/inclusion criteria outnumbered the behavioral ones by a factor of four. Moreover, on average, the investigated normative articles were cited 256 times, whereas citation was only 63 times for the behavioral/mixed ones. Besides the fact that the behavioral stream of research is younger than the normative one (the average year of publication is 2002.2 for the normative subset and 2003.0 for the behavioral/mixed subset), the lower citation count might be an indicator of a lack of awareness of behavioral topics. We have thus tried to stimulate interest in this important area by articulating several research questions. Therefore, this paper can serve as a basis for subsequent research and theory development. Further studies can answer the proposed research questions, further explore this assumption revision effort, and also expand the list of offered research questions based on the alternative assumptions.

The methodological contribution of this paper is to the problematization approach offered by Alvesson and Sandberg (2011) and to the literature review as grounded theory approach advanced by Wolfswinkel et al. (2013). By marrying these review methods, we suggest and showcase that the dialectical interrogation mechanism of problematization can be implemented by using a grounded theory approach to literature review; we thus treat the articles as data and their assumptions as codes. More precisely, adopting an open and axial coding approach (Strauss and Corbin 1990), we suggest that, first, different manifestations of the assumptions can be coded in an open-coding fashion; and these manifestations can then be merged in an axial coding procedure to form more abstract assumptions.

Overall, we believe that IT projects encompass complexities that have been simplified in order to develop risk management prescriptions. However, keeping with the recent behavioral research, we believe that these simplifying assumptions provide a partial picture of the reality of IT projects that evacuates the role of IT project managers in project risk management. Therefore, the "decision-making assumptions are key to understanding why prescriptions from the risk management and risk factor strands of research appear to be so difficult to apply in IT projects" (Taylor et al. 2012, p.18). We thus emphasize a need to go beyond the dominant 'hyper rational' view of risk management (Kutsch and Hall 2010) and to focus on perceiving and responding to risks as something that individuals, especially IT project managers, do. We also highlight the need to focus more on enacting specific risk responses by trying to keep some distance from the formality of risk management, acknowledging that "[t]he formal management of risk, although of importance, can disguise the fact that project managers also engage with risks in a less visible, more informal, tacit way" (Kutsch et al. 2012, p. 4).

Appealing to our review, we reiterate that "[f]urther research is needed to investigate whether these gaps are due to a lack of understanding of the prescriptions on the part of the project managers, or whether the prescriptions themselves are inadequate to support the practical realities of IT project implementation" (Taylor 2005, pp. 442-443). While one might point to inadequate training in the existing prescriptions as an immediate answer, Kutch et al. (2012, p. 4) have found that "lack of familiarity with typical risks and risk management … did not emerge as a key factor of disengagement" from applying risk management practices. Therefore, we believe that both risk management training and risk management prescriptions need to be updated if the existing gap between research and practice is to be closed (Bannerman 2008; Taylor et al. 2012).

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Appendix A: Coding Scheme for Research Objectives

Code	Description
Normative	• The main objective of the article is to provide better ways of assessing or responding to risks, ways that IT project managers do/should/can/would follow in order to have higher chances of project success. • The main objective of the paper is to identify/develop a risk management best practice to be adopted by practitioners - The main objective is to investigate the impact of risk sources on project success, so that key risk sources that should be mitigated are identified, the effect of risk mitigations are examined, or the need for risk management is justified. • Some examples are: - Offering or showcasing a risk management process (and its contents), - Developing and examining risk factor lists/risk mitigation lists, and - Examining which risk source/risk response is more conducive to project success and when.
Behavioral	• The main objective is to describe/explain how and why risk management is (or is not) practiced. • The main objective of the paper is to describe or explain how IT project managers perceive risks and respond to them in real-life projects. • Some examples are: - Examining the antecedents of risk perception - Examining the antecedents of applying formal risk management practices (use of tools and methods, individually, or in a sequence) - Examining the antecedents of enactment of specific risk responses
Mixed	• The paper either has both objectives at the same time or the objectives cannot be separated.

Appendix B: Details on the Investigated Articles

Study	Citations	Concepts	Type	Journal
Studies with A Main Normative Research Objective				
Boehm (1991)	1578	A/R	C	IEEE Software
Schmidt et al. (2001)	776	A	E	JMIS
Keil et al. (1998)	661	A/R	E	C. of ACM
Barki et al. (1993)	659	A	E	JMIS
Sumner (2000)	524	A	E	JIT
Nidumolu (1995)	425	A/R	E	ISR
Barki et al. (2001)	375	A/R	E	JMIS
Scott and Vessey (2002)	298	A/R	E	C. of ACM
Wallace et al. (2004a)	287	A	E	Decision Sciences
Ropponen and Lyytinen (2000)	282	A/R	E	IEEE T. on SW. Eng.
Wallace et al. (2004b)	272	A	E	Information & Management
Fairley (1994)	209	A/R	E	IEEE Software
Whittaker (1999)	205	A	E	Info. Mgmt. and C. Security
Ehie and Madsen (2005)	192	A	E	Computers in Industry
Nidumolu (1996)	186	A/R	E	JMIS
Wallace and Keil (2004)	179	A	E	C. of ACM
Jiang and Klein (1999)	151	A	E	Information & Management
Moynihan (1997)	136	A	E	IEEE Software
Jiang and Klein (2000)	133	A	E	JS&S
Tiwana and Keil (2004)	129	A	E	C. of ACM
Fan and Yu (2004)	127	A	C	JS&S
Huang et al. (2004)	123	A	E	Industrial Mgmt.& Data Sys.
Sauer et al. (2007)	123	A	E	C. of ACM
Neumann (2002)	116	A	C	IEEE T. of SW. ENG.
Baskerville and Stage (1996)	114	A/R	E	MIS Quarterly
Han and Huang (2007)	106	A	E	JS&S
Jiang et al. (2001)	103	A	E	IEEE T. of ENG Mgmt.
Madachy (1997)	102	A	C	IEEE Software
Kitchenham and Linkman (1997)	94	A	C	IEEE Software
Bussen and Myers (1997)	92	A	E	JIT
Sherer and Alter (2004)	90	A	C	C. of AIS
Addison (2003)	90	A	E	Int. J. of Info. Mgmt.
Lyytinen et al. (1996)	90	A/R	E	JIT
Conrow and Shishido (1997)	89	A/R	E	IEEE Software
Tesch et al. (2007)	75	A/R	E	J. of Computer Info .Systems
Heemstra and Kusters (1996)	63	A/R	E	JIT
Studies with A Behavioral or Mixed Research Objective				
Lyytinen et al. (1998)	264	A/R	C	ISR
Bannerman (2008)	142	A/R	E	JS&S
Keil et al. (2002)	135	A	E	ISJ
Baccarini et al. (2004)	123	A	E	Industrial Mgmt.& Data Sys.
Addison and Vallabh (2002)	101	A/R	E	Proceedings of SAICSIT
Charette (1996a)	100	A/R	C	IEEE Software
Keil et al. (2000a)	98	A/R	E	JS&S
Ropponen and Lyytinen (1997)	83	A/R	E	EJIS
Boehm and DeMarco (1997)	82	A/R	C	IEEE Software
de Bakker et al. (2010)	79	A/R	C	IJPM
Drummond (1996)	78	A/R	E	JIT
Gemmer (1997)	68	A/R	E	IEEE Software

Pfleeger (2000)	67	A/R	C	JS&S
Kutsch and Hall (2010)	67	A/R	E	IJPM
Glass (1999)	63	A	C	C. of ACM
Moynihan (1996)	61	A	C	JIT
Kutsch and Hall (2005)	58	A/R	E	IJPM
Charette (1996b)	54	A/R	C	JIT
Keil et al. (2008)	46	A/R	E	JS&S
Pablo (1999)	39	A	E	J.M. Psyc
Du et al. (2007)	37	A/R	E	DSS
Smith et al. (2001)	32	A/R	C	C. of AIS
Jiang et al. (2009)	30	A	E	JS&S
McGrew and Bilotta (2000)	30	A/R	E	Management Decision
Moynihan (2002)	29	A/R	E	Information & Management
Taylor (2006a)	26	R	E	PMJ
Lister (1997)	25	R	C	IEEE Software
Taylor (2005)	23	A/R	E	IJPM
Kutsch and Hall (2009)	21	A/R	E	PMJ
Moynihan (2000)	20	A/R	E	JS&S
Taylor et al. (2012)	19	A	E	JIT
Carr (1997)	19	A/R	C	IEEE Software
Ropponen (1999)	19	A/R	E	Book Chapter
Lauer (1996)	18	A/R	E	JIT
Huff and Prybutok (2008)	17	A/R	E	PMJ
Kutsch et al. (2012)	5	A/R	E	EJIS

Table Legend:

A: The article focuses on risk assessment.
R: The article focuses on risk response.
C: The article is a conceptual piece.
E: The article is an empirical piece.

Chapter 3
Essay 2: Identifying the Determinants of Preferring Experiential or Analytical Risk Assessment Process in IT Projects

Abstract

Most of IT project risk management literature has treated risk assessment as an analytical process. Yet, research shows that risk assessment is sometimes an experiential process, with project managers preferring to use heuristics or rely upon their expertise-based intuition (gut feelings). With this paper, we aim to increase our understanding of the determinants of preferring one process over another.

By adopting analytic induction, we first drew from the dual-process theories of judgement and decision making and deductively developed a preliminary specification of the two processes and the determinants of preferring one over another. We then inductively developed more situated propositions using multi-technique interviews with 24 IT project managers.

Our data suggested five determinants of choosing one process over another. They include: Having formal project management training, experience (number of years of IT project management), perceived cognitive resource demanded by process, perceived process accuracy, and time into project. Moreover, noticing that oftentimes an initial experiential assessment is complemented with a follow-up analytical assessment, we looked at what determines performing the analytical assessment. The two determinants emerging from our data are perceived need for evidence-backed-up communication of risks and perceived need to comply with an analytical risk response mandate.

We contribute to the behavioral research on IT project risk management by shedding some light on the use of experiential risk assessment processes, including the use of heuristics and relying upon expertise-based intuition. Moreover, we offer several propositions on what determines the use of experiential or analytical risk assessment processes. We discuss the implications for future research.

3.1 Introduction

IT projects are challenging undertakings for organizations (Bloch et al. 2012; Flyvbjerg and Budzier 2011). Risk management can contribute to the success rate of these projects (Barki et al. 2001). The first step in risk management is assessing risks (Boehm 1991), and it is crucial for motivating risk responses, i.e., project management activities aimed at preventing undesired outcomes from occurring or minimizing their impact if they occur (Bannerman 2008). For example, in an IT implementation project, noticing that end-users have a negative attitude towards the system is key to enacting risk responses such as increasing user participation to prevent user resistance (Barki and Hartwick 1994). Therefore, risk assessment is of paramount importance to accomplishing IT projects and, as such, is a fundamental function of IT project managers (Charrette 1996; Kutsch and Hall 2009).

The literature has consistently treated IT project risk assessment as an *analytical* process (Boehm 1991; Barki et al. 1993; Charette 1996). In essence, such an analytical process involves taking certain steps—e.g., using checklists (Lyytinen et al. 1998)—to identify risk sources (i.e., threats to a project's success) and to evaluate the risk exposure (i.e., probable loss) ensuing from the risk sources (Boehm 1991). In order to facilitate and guide this process, much research has focused on developing risk assessment tools and techniques. Nevertheless, the behavioral studies of risk management have found that sometimes such tools and techniques are not used (Bannerman 2008; Ropponen 1999) or have limited impact on the risk perception of project managers when used (Baskerville and Stage 1996; Du et al. 2007). These findings suggest that the *experiential* risk assessment processes—e.g., assessing risks through "gut feelings" (Ropponen 1999)—are an integral part of the lived reality of IT project managers. Yet, only a few researchers have investigated such experiential processes (e.g., Kutsch and Maylor 2011; Shalev et al. 2014; Taylor 2007). Moreover, the few researchers who did so were not looking to open the black box of experiential risk assessment processes; rather, they sought to examine the biases exhibited in the outputs of these processes, that is, over/underestimations in the perceived risk (e.g., Kutsch and Maylor 2011; Shalev et al. 2014). Studies that discuss experiential processes include Kutsch et al. (2012) and Taylor

(2007). Kutsch et al. studied mindfulness-based risk management, and Taylor studied situational awareness. While both works move away from the use of formal risk assessment tools and techniques, they still treat risk assessment as an informal analytical process. Therefore, research dedicated to the experiential processes is scarce.

Given this state of research, we believe that there are strong motivations to build more theories of the experiential risk assessment processes in an IT project management context. Through increasing our understanding of why sometimes the prescribed risk assessment tools and techniques are not—purposefully—used, stronger behavioral theories can be developed for designing better tools and techniques (Keil et al. 2008; Taylor et al. 2012). Moreover, we believe that a deeper understanding of the experiential risk assessment processes can inform and stimulate further discussion on situational awareness (Taylor 2007; Kutsch et al. 2012) and mindfulness-based risk management (Kutsch et al. 2012), two recently discussed alternatives to the dominant normative view on risk management. Therefore, in order to contribute to theory in this area, we investigate the question: *In the context of IT project risk management, what are the antecedents of preferring experiential risk assessment processes over analytical ones?*

In this theory-building effort, we adopted analytic induction, which complements an initial deductive stage with an inductive one to adjust the propositions in light of qualitative data (Patton 2002). Using this approach, we first developed an initial understanding of the two processes and the motivations behind preferring each of them by drawing from the dual-process theories of judgement and decision making (e.g., Kahneman and Fredrick 2005) and their adaptations to the management context (e.g., Dane and Pratt 2007; Dane 2010; Salas et al. 2010). We then developed propositions by analyzing qualitative data collected via multi-technique interviews with 24 IT project managers.

Our contributions are twofold. First, we shed some light on experiential risk assessment processes that IT project managers use, including the use of heuristics (i.e., effort reduction techniques—Shah and Oppenheimer 2008) and reliance upon expertise-based intuition (i.e., automatic, unconscious use of expertise coupled with affective discharge—

Salas et al. 2010). Moreover, we propose various determinants for the use of experiential processes, including the following: The project manager's (individual) characteristics (formal project management training, such as being PMP certified, the number of years of IT project management experience), risk assessment process characteristics (perceived cognitive resource demanded by process, perceived process accuracy), project characteristics (time into project), and organizational characteristics (perceived need for evidence-backed-up communications and perceived need for complying with an analytical risk assessment mandate).

We begin the paper by briefly reviewing the extant normative and behavioral studies of IT project risk assessment.

3.2 Risk Assessment Processes in IT Projects

3.2.1 Normative Prescriptions

The classical decision theories, such as expected utility theory (von Neumann and Morgenstern 1947), characterize decision making as an analytical process. Accordingly, after identifying the possible decision alternatives, each decision alternative needs to be analyzed by gathering the relevant cues (i.e., items of information) and processing them. In particular, the gathered cues need to be processed to (1) identify a range of probable outcomes, (2) assign probability and magnitude values to each identified outcome, and then (3) make an overall evaluation using a weighting function that integrates the probability and magnitude values. Next, a decision is made by comparing the evaluations of different decision alternatives.

As several researchers have previously noted (e.g., Lauer 1996; Charrette 1996; Kutsch and Hall 2009), the normative body of research on IT project risk management has built heavily upon such classical decision theories. Risk assessment in IT projects has been characterized as the process of (1) identifying the range of risk sources and the undesired outcomes that they may cause, (2) assigning probability and magnitude values to the undesired outcomes, and (3) calculating the resulting risk exposure by multiplying the aggregation of probability and magnitude values of the undesired outcomes (Barki et al. 1993; Boehm 1991; Charette 1996). Consequently, researchers and practitioners have offered a wealth of risk assessment tools and techniques to support and guide this analytical process. These include risk checklists (e.g., Keil et al. 1998; Lyytinen et al. 1998; Schmidt et al. 2001), risk exposure instruments (Barki et al. 1993), computer-aided risk assessment tools (e.g., Keil et al. 2008), computer-aided risk simulations (El-Masri 2013), and other similar tools. An example of risk assessment techniques is to conduct risk assessment sessions and meetings (Bannerman 2008), for instance, in order to brainstorm on risk sources and on the probabilities and magnitudes of undesired outcomes due to the risk sources.

In depicting risk assessment as an analytical process, the literature has depended on two premises: First, an analytical risk assessment process, especially guided by tools and techniques, will increase the accuracy of risk assessments (Keil et al. 2000). Second, such tools and techniques will—most likely—be used (de Bakker et al. 2010) and influence managers' risk perceptions.

3.2.2 Behavioral Views and Examining Extant Models of Experiential Risk Assessment

Behavioral research on IT project risk management, however, displays a different picture of actual risk assessment processes in real-world IT projects. Risk assessment tools are not used (Bannerman 2008) or have a limited impact on managers' risk perceptions when used (Du et al. 2007). Risk assessment is suggested to be to a large extent experiential, e.g., based on gut feelings (Ropponen 1999). Some managers prefer to rely on their own experience rather than the outputs of a tool (Baskerville and Stage 1996). In particular, some IT project managers have been found to believe that the output of tools is not accurate (de Bakker et al. 2010; Kutsch and Hall 2005; Kutsch et al. 2012). Some managers have even stated that they have acted against their intuition only because of the power and politics enforcing them to act upon risk analyses, yet with hindsight, they would trust their intuition (Drummond 1996).

While the above evidence suggests that—purposeful—IT project risk assessment is, at least in part, experiential, the studies that actually open the black box of such experiential processes are scarce. Most of the few studies that pertain to experiential risk assessment look at antecedents of risk perception, for example, whether the use of risk assessment tools (Du et al. 2007; Keil et al. 2008) or experience (Huff and Prybutok 2008) explains significant variance in risk perceptions. Thus, they are far from explaining what the experiential processes are and elaborating on why they are preferred over analytical ones. Moreover, two studies that have to some extent looked at these issues (Purvis et al. 2004, McCray et al. 2002) are concerned with overall IT project planning and are not specific to risk management.

The two relevant articles that we found were Kutsch et al. (2012) and Taylor (2007). Kutsch et al. (2012) investigated routine-based risk management, that is, the following of certain procedures and steps that over time have become organizational routines. They found that some project managers believe that risks identified from such procedures are not real, and that performing risk management routines is sometimes not worthwhile as it creates unnecessary anxiety in project stakeholders and is sometimes interpreted as a lack of confidence in being able to accomplish the project. Consequently, Kutsch et al. recommend considering mindfulness-based risk management, which involves situational awareness and being open to new information. They believe that mindfulness-based risk management can be functional under certain circumstances. Kutsch et al. however, suggest this as an avenue for future research and do not delve into it.

The notion of situational awareness has been more deeply explored by Taylor (2007). Taylor compared and contrasted the analytical risk assessment process (which she refers to as rational decision making) and the naturalistic decision making process (Klein 1999). Naturalist decision making is based on situational awareness and cue learning. Cues are implicit or explicit signs of (items of information about) risks, which could come from a variety of sources, including one’s experience, verifying a contract, noticing a change in the project, etc. Taylor sought which process could better explain the risk management performed by IT project managers. She found that project managers use a mix of these processes, depending on whether the project is in trouble and the time into the project. More precisely, she observed that while project managers use the naturalistic approach for routine projects, they use the rational process for troubled projects. Moreover, while the initial assessment of projects is done mostly according to the rational approach, decision making during the course of the project has a naturalistic character. Taylor suggests that naturalistic decision making underperformed the rational one in two ways: first, by creating “gaps in their risk response planning, and particularly in the management of any contingency allowances for high risk tasks” and, second, by leading “to a blind spot in terms of risk identification” (p. 15).

Notwithstanding the contributions of these two studies, we have identified a number of areas that need expanding. First, the descriptions of the mindfulness-based risk management (Kutsch et al. 2012) and naturalistic decision making (Taylor 2007) are still to a large extent analytical. Yet, an understanding of the more experiential processes (e.g., intuition and gut feelings) is lacking. Second, the list of the motivations for preferring experiential methods over analytical ones could be further expanded and elaborated. In particular, there seems to be disagreement on whether experiential processes are perceived to be functional at all. While Kutsch et al. consider mindfulness-based risk management to be sometimes functional, Taylor reports that naturalistic processes were dysfunctional. Therefore, more research is required into whether IT project managers might believe experiential processes to be functional under certain circumstances, for example, as was the case with the infamous Taurus project (Drummond 1996).

In the remainder of this paper, we follow this line of thought by developing some propositions.

3.3 Dual-process Theories of Judgment and Decision Making

From a decision-making perspective, risk assessment is an instance of judgments, with judgments referring to “subjective assessments made as a prelude to taking action” (Solomon and Trotman 2003, p.396). To develop an initial understanding of the experiential processes and how they differ from analytical ones, we refer to dual-process theories of judgment and decision making (e.g., Kahneman and Fredrick 2005).

The dual-process theories of judgment and decision making suggest two judgment processes: experiential and analytical. The difference between these processes is best understood by comparing their characteristics, such as outcome emergence, involvement of affect, required effort, speed, consciousness, hardwired in mind, level, problem decomposition, sequence of process, and control. Experiential judgments are fast and do not demand much cognitive effort—especially about complex problems (Kahneman and Fredrick 2005). The output of such judgment processes are more felt than thought. The judgment process is subconscious or unconscious, and the problem is solved as a whole without being decomposed into pieces (Dane et al. 2012). In contrast, analytical processes are effortful and controlled reasoning based on available information—for example as it is with System 2 (Kahneman and Fredrick 2005). They could involve deep thinking and use of comprehensive logic. The problem is decomposed into pieces, the items of information are gathered and processed to evaluate each piece, and then a decision is made.

To better understand the dual-process theories of judgement and decision making, we mapped different processes onto a spectrum (Figure 3.1). The two processes explained above represent the two extreme ends of the spectrum, with several more concrete processes lying between them. As with the two extremes, the more concrete instances differ from each other in terms of some of their characteristics.

Analytical ⟵⟶ **Experiential**

Specific Processes

System 2 (reasoning): [As compared to System 1,] The operations of System 2 are slower, serial, effortful, more likely to be consciously monitored and deliberately controlled; they are also relatively flexible and potentially rule governed. (Kahneman 2003, p.698)

Method-driven Analysis: A step-by-step use of tools or implementation of techniques to evaluate the probable outcomes of each decision alternative and make a decision, e.g., following the "weighted additive rule" (Shah and Oppenheimer 2008, p.207).

Deliberation (analytical Decision making): "Analytical Decision making involves basing decisions on a process in which individuals consciously attend to and manipulate symbolically encoded rules systematically and sequentially (Alter, Oppenheimer, Epley, & Eyre, 2007)." (Dane et al. 2012, p.188)

Guessing: Guessing is fast and deliberate thinking and "neither involves affectively charged judgments nor requires making associations through nonconscious information processing." (Dane and Pratt 2007 p.40)

Insights: "Insights or 'sudden unexpected thoughts that solve problems' (Hogarth, 2001: 251)" differ from other experiential methods in that they start with deliberate thinking (Dane and Pratt 2007, p.40).

Heuristics: Heuristics are "methods that use principles of effort-reduction and simplification. By definition, heuristics must allow decision makers to process information in a less effortful manner than one would expect from an optimal decision rule." (Shah and Oppenheimer 2008, p.207)

Intuition: "intuitions are affectively charged judgments that arise through rapid, nonconscious, and holistic associations." (Dane and Pratt 2007, p.40). Intuitions are also referred to as gut feelings or gut instincts (Dane and Pratt 2007, p.40).

Instinct: "Biological instincts (e.g., shutting one's eyes in the presence of bright light) are "hardwired" responses or autonomic reflexes to stimuli." (Dane and Pratt 2007 p.40) [Kahneman (2003) calls this "perception," which is a response to a current stimulation and difficult to be put in words.]

System 1 (intuition): "The operations of System 1 are typically fast, automatic, effortless, associative, implicit (not available to introspection), and often emotionally charged; they are also governed by habit and are therefore difficult to control or modify." (Kahneman 2003, p.698)

Characteristics

Thought ←	Outcome Emergence	→ Felt
Affect-void ←	Involvement of Affect	→ Affect-rich
Effortful ←	Required Effort	→ Effortless
Slow ←	Speed	→ Fast
Conscious ←	Consciousness	→ Unconscious
Not Hardwired ←	Hardwired in Mind	→ Hardwired
Can be Collective ←	Level	→ Individual
Decomposed ←	Problem Decomposition	→ Holistic
Serial ←	Sequence of Process	→ Parallel
Controlled ←	Control	→ Automatic

Figure 3.1 A Compilation of Different Judgment and Decision-making Processes

3.3.1 Experiential Processes: Heuristics and Expertise-based Intuition

Among the concrete experiential processes, we focus on heuristics and intuitions because they are the two commonly discussed experiential processes in the managerial decision making literature (Akinci and Sadler-Smith 2012). Heuristics refers to effort-reducing strategies (Shah and Oppenheimer 2008; Tversky and Kahneman 1974). As Shah and Oppenheimer (2008) suggest,

> all heuristics rely on one or more of the following methods for effort-reduction: 1. Examining fewer cues. 2. Reducing the difficulty associated with retrieving and storing cue values. 3. Simplifying the weighting principles for cues. 4. Integrating less information. 5. Examining fewer alternatives. (p. 209)

For example, using an attribute-substitution heuristic means replacing the inaccessible answer to a difficult question (here a judgment to be performed) with an accessible answer to a related—but different and easier—question, with accessibility referring to “the ease (or effort) with which particular mental contents come to mind” (Kahneman and Fredrick 2005, p. 271). For instance, when judging costs and benefits of performing a certain risk response in a particular project, instead of analyzing what could happen in that project, an IT project manager might refer to the easily remembered outcomes of performing such a practice in previous projects.

Intuitions, like heuristics, are effortless and fast. Yet, intuitions are more automatic, less conscious, and more affect-laden than heuristics (Dane and Pratt 2007). In particular, when one uses intuition, an “affective charge is subjectively experienced as an output referred to colloquially as ‘gut feel’” (Akinci and Sadler-Smith 2012, p. 116). In the management context, several studies argue that managers rely on their intuition when they make decisions (e.g., Dane and Pratt 2007). It is suggested that this intuition is shaped through expertise (Salas et al. 2010). Such expertise-based intuition is defined as “the intuitions occurring at these later stages of development where the decision maker has developed a deep and rich knowledge base from extensive experience within a domain” (Salas et al. 2010, p. 4).

3.3.2 Analytical Processes: Method-driven Analysis and Deliberation

Among the concrete analytical processes, we focus on deliberation and method-driven analysis. We consider deliberation because what is typically known as "analysis" in the judgment and decision making literature is as one's thinking and decision making, which involves decomposing a decision into alternatives and then evaluating each alternative by analyzing its probable outcomes, mostly through an informal, implicit process. Nonetheless, given our organizational context, we need to consider the use of tools and techniques (e.g., group brainstorming) and distinguish the effortful use of tools and techniques from a simple deliberation about a decision, as they differ in the amount of required effort. For this reason, we also consider method-driven analysis and characterize it to be slower and more effortful than deliberation. For instance, in the context of risk management, a method-driven analysis explicitly uses risk assessment tools and relies upon their outputs to assess risks (Keil et al. 2000; Keil et al. 2008).

3.3.3 The Link between Experiential and Analytical Processes

Having separated experiential and analytical processes, we acknowledge that a judgment might not necessarily be purely experientially or analytically based. For example, System 1 and System 2 can work concurrently and influence one another (Kahneman and Fredrick 2005). As Kahneman (2011) explains, at first, System 1 might engage; but System 2 monitors its output and if it senses something abnormal, it engages to correct it. An example in the present context is the findings of Baskerville and Stage (1996), which suggest that first intuition is exhausted and then analysis is used.

Moreover, while several researchers have separated the analytical and experiential processes presented above, researchers diverge on whether the two processes are inherently separable. For example, Simon (1987, p. 63) suggests that "[i]t is a fallacy to contrast 'analytic' and 'intuitive' styles of management. Intuition and judgment—at least good judgment—are simply analyses frozen into habit and into the capacity for rapid response through recognition."

In this paper, we espouse the view that experiential processes, especially expertise-based intuition, are—to a large extent—learned through experience with the analytical processes over time (Salas et al. 2010). Nonetheless, we believe that the risk assessment performed at a given point of time by a particular manager in a particular project can be attributed to different decision making processes on the basis of its characteristics, for example, how fast it emerges.

3.3.4 The Determinants of Preferring One Decision-making Process over Another

Distinguishing the two processes takes us to our research question, i.e., why a certain judgment is performed by one or a combination of these processes. The literature suggests that whether one uses experiential or analytical processes can be influenced by a set of determinants. In particular, Kahneman and Fredrick (2005) suggest that the relative contribution of these processes to the final judgment depends on "both task features and individual characteristics" (p.268). We identified some individual and task (or task environment's) characteristics.

First, some individual characteristics can determine which process is preferred. As Dane et al. (2012) argue, "individuals differ in their tendency to favor intuition and analysis respectively" (p. 192). This could be a rather long term preference. Moreover, Salas et al. (2010) suggest that expertise leads to expertise-based intuition.

Second, some task characteristics can influence the use of a process. In the judgment and decision-making literature, whether experiential processes are functional or dysfunctional for a judgment task is debated. Whereas Kahneman (2003) refers to errors of intuition, Gigerenzer and Gaissmaier (2011) suggest that, in reality, sometimes intuitive judgments can correct erroneous reasoning. Supporting the latter view in the management context, Dane et al. (2012) find that intuitive judgment processes can perform better than analytical ones under certain conditions, in particular, when the task is not decomposable into some pieces that can be judged separately. Moreover, Dane et al. (2012) suggest that the use of intuitive judgments increases with time pressure. They also suggest that the use of analytical methods increases by instructing people to decompose a task and provides them with the criteria they can use for their judgments.

Overall, the brief synthesis of the dual-process theories of judgement and decision making presented above suggests that risk assessment can be analytical (e.g., deliberation or method-driven analysis) or experiential (e.g., using heuristics or expertise-based intuition) and that individual and task characteristics influence the relative preference for these processes. We develop this synthesis into a conceptual framework of the processes and their determinants (Figure 3.2). This conceptual framework provides an initial understanding that guides and bounds our data collection (Miles and Huberman 1994). In the next section, in accordance with our analytic induction approach, we situate these processes and their determinant in the IT project risk assessment context by using qualitative data. In doing so, we provide a finer-grained understanding of each determinant, extend the set of determinants, and provide support for its influence on process use based on data.

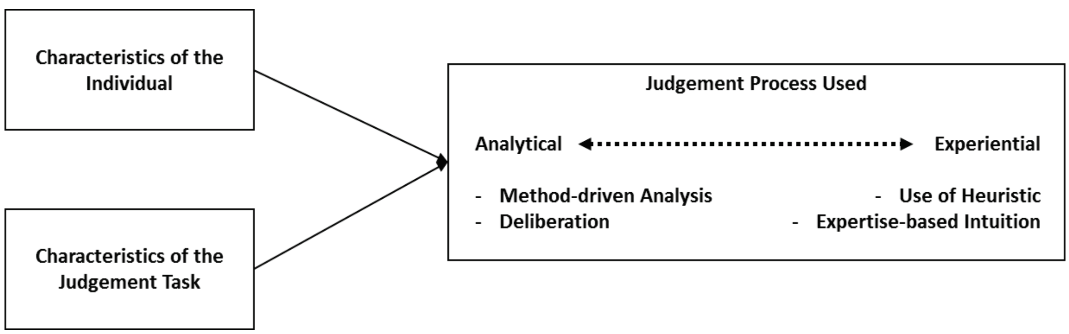

Figure 3.2 A Conceptual Framework of the Judgement Processes and their Determinants

3.4 Research Method

We conducted a qualitative research to expand the mentioned areas. A qualitative study was chosen over conducting experiments, as developing more nuanced hypotheses to be tested in experiments requires some initial understanding of the phenomena, yet the current understanding of the experiential risk assessment processes in IT project risk management is very immature. In particular, we adopt analytic induction, an approach in which

> qualitative analysis is first deductive or quasi-deductive and then inductive as when, for example, the analyst begins by examining the data in terms of theory-derived sensitizing concepts or applying a theoretical framework developed by someone else. […] After or alongside this deductive phase of analysis, the researcher strives to look at the data afresh for undiscovered patterns and emergent understandings (inductive analysis). (Patton 2002, p. 254)

In the previous section, we developed a preliminary understanding of the determinants of preferring one risk assessment process over another. To continue our analytic induction approach, we conducted a qualitative study to inductively elaborate propositions.

3.4.1 Interview Techniques to Uncover the Use of Risk Assessment Processes

Uncovering the judgment processes people use requires rich data about how they think. This is not a straightforward task, especially in an organizational context. We, therefore, implemented multiple interview techniques (Glöckner and Witteman 2010; Patton 2002) that pertained to our investigation.

The broad techniques pertain to the study of judgment processes: concurrent thinking and thinking in retrospect (Payne 1994). Each of these two approaches has its merits and drawbacks. On the one hand, concurrent techniques assign respondents a judgment task such as a scenario; and thus, they are observed as they make their judgments. This approach requires implementing a technique that captures the judgments as they are performed in one's mind (Patton 2002). Yet, in a management context, the judgment tasks would be hypothetical scenarios and may be distant from real-world managerial judgments (Dane and Pratt 2009). Thus, it would be difficult to create very realistic variations in the tasks or the environment.

On the other hand, retrospective judgments are rich, for they pertain to significant situations in real life, for example, risk incidents in IT projects; yet tapping into experiential thinking processes in retrospect is a challenging task, as managers tend to rationalize their judgments and perform "post-hoc interpretation" (Dane and Pratt 2009, p.18). Implementing this approach requires creating a safe sharing environment in an interview, most likely through talking directly about how experiential processes correspond to one's past experiences, without attempting to enforce a certain type of response (Patton 2002).

To retain the benefits of these approaches, we implemented techniques from both. In a concurrent judgment approach, we used concurrent think-aloud protocols about a specific project scenario. In retrospective thinking, we used storytelling and probing, giving examples and asking for self-evaluation, and providing a prefatory statement and asking for examples. In doing so, we started each interview by implicitly seeking the use of both risk assessment processes, and then we gradually shifted the interview towards a more explicit and open-ended discussion of these processes. The specific techniques we adopted are explained below.

1- Conducting concurrent think-aloud protocols: In the judgment and decision-making literature, cognitive processes has usually been studied by putting subjects in a concurrent judgment situation. One technique that allows respondents to provide intuitive responses is the think aloud protocol (Glöckner and Witteman 2010). According to Patton (2002), "the *think-aloud protocol* approach [...] aims to elicit the inner thoughts or cognitive processes that illuminate what's going on in a person's head during the performance of a task, for example, painting or solving a problem" (p. 385). Think aloud is particularly recommended for tracing the use of heuristics and intuition in judgment and decision making (Ericsson and Simon 1998; Glöckner and Witteman 2010).

In this technique, respondents are provided with a judgment task and are asked to think out loud when they are performing it. It can be performed about concurrent or retrospective judgments. But the retrospective think aloud primes respondents for providing analytical responses. Therefore, as the main method of data collection, we performed the concurrent "think-aloud protocol" using a hypothetical scenario (Ericsson and Simon 1998; Patton 2002). Respondents were not forced to provide a response immediately, as doing so would prime them to provide experiential (heuristic-based or intuition-based) responses (Pratt et al. 2012). They were instructed to take their time, but to think aloud. Before the intended think-aloud protocol began, respondents were given a warm-up task to make sure the think-aloud protocol was secondary to their judgment and decision making about the main subject (Payne 1994). In this warm-up task, they were encouraged to think out loud, but not to respond quickly or provide a certain type of judgment. The implemented hypothetical project scenario is included in the Appendix. The respondents were asked to reflect on their judgments about the existence of significant project risks. In doing so, the respondents were asked to think out loud while they were assessing the risks involved in the scenario. After they provided their answer, we posed further probing questions, for example: “What came to your mind immediately after hearing this scenario?”

2- Asking for story-telling about the current project: To ensure that we had covered the full chain of evidence during an interview, we started by first asking broad questions. We asked simple, truly open-ended questions. For example, “Please tell us the story of the project you currently manage.” On the basis of the interviewee’s response, we asked a few probing questions to seek more details and clarity, and to redirect the story-telling towards our areas of interest (Patton 2002), which were identification of risk sources and evaluation of their risk exposure. If a risk was identified, we posed probe questions related to how the respondents became aware of that risk.

3- Giving examples and asking for self-evaluation: Next, we used the “illustrative example” technique (see Patton 2002, p. 366), which suggests beginning an interview question with some examples of answers provided by other interviewees. This creates neutrality; we do not present being intuitive or analytical as either good or bad. Following this technique, we told respondents: “In our past interviews, some project managers told us that they often identify risks by trusting their gut while others identify risks by deliberating and analyzing them. How about you—which one characterizes your way of assessing risks?” We also asked them, “Please locate your experience on a spectrum with the frequent trust on gut feel of risk on the one end and frequent assessment of risk by deep thinking, using tools, and implementing techniques on the other end.”

4- Asking for examples for the use of each risk assessment process: One method used is the critical incident technique, which asks respondents to identify a risk they had faced and to justify how they came to realize it was a risk. However, asking respondents to retrospectively justify their previous judgments primes them to provide analytical responses. Therefore, when asking questions about the past we specifically asked them to provide examples of when their gut feeling led them to identify a significant risk. We read a standard script to the respondents and explained what “assessing risk by gut feeling and intuition” and “assessing risks by analysis” means to us when it comes to assessing project risks. Then, we asked the respondents to provide two concrete recent (within the past six months) examples, one in which their gut feel led them to identify a risk, and another in which deliberate thinking about risks, especially using tools and techniques, helped them to identify a risk. We then posed probe questions, for example about what they were thinking or feeling at the moment.

5- Open discussion about the two processes: Before the end of the interview, we held an open discussion with the interviewees on what they thought about risk assessment based on intuition and gut feeling or based on analysis. We posed probe questions to ask their opinion about the advantages and disadvantages of each cognitive process.

3.4.2 Data Collection

To select our respondents, we used the maximum variation sampling strategy (Patton 2002). In particular, we tried to maximize variation in project management training, experience, education, and project size to allow searching for patterns linking their demographics to the risk assessment processes they use. To identify such respondents, we used the Advanced Search feature on the www.linkedin.com website. We sought to include IT project managers that have varying levels of project management training (being or not being PMP certified), numbers of years of experience, education, and experience in managing large-size projects. We mainly sought project managers who were based in Montreal, Quebec, Canada, in order to be able to interview them face-to-face. We sent personalized invites to the matching profiles. Data was collected from semi-structured face-to-face and phone interviews that lasted between 45 and 60 minutes. All interviews were recorded after obtaining the interviewees' consent and were partially transcribed afterwards. Data collection was continued until we reached the theoretical saturation point. Overall, 24 project managers were interviewed. The summary demographics are displayed in Table 3.1.

Table 3.1 Demographics of Respondents

PMP Certified?	Yes	12
	No	12
IT Project Management Experience	Less than 5 years	5
	5 to 10 Years	7
	10 to 20 years	8
	20 years or more	4
Education	Undergraduate degree or lower	12
	Graduate or postgraduate	12
Largest IT Project Ever Managed ($)	$100K	5
	$100K to $1M	5
	$1M to $5M	6
	$5M to $20M	5
	$20M or more	3

3.4.3 Data Analysis

Data analysis was started parallel to data collection. A unit of qualitative data was created based on each interview. Coding was performed in an open and axial fashion (Strauss and Corbin 1990) in NVivo 10 (www.qsrinternational.com). After identifying the meaning units in the data, a code or some overlapping codes were assigned to each of the segments (Miles and Huberman 1994). The initial codes were inspired by our preliminary specification of the two processes and the determinants of preferring one of them over the other. In the next step of our analysis, we used open coding to be as faithful as possible to the data; then, we implemented axial coding to specify emerging constructs.

More precisely, for the concurrent part, we coded the instances of experiential or analytical thinking when assessing risks. In the retrospective part of the interviews, each project manager provided several examples that comprise using different risk assessment processes. We considered each example as an episode of assessing project risks, and we coded whether the episode involves using experiential and/or analytical risk assessment processes. We then coded and sought the project and organizational characteristics that motivated the use of each process in the episode.

To separate experiential from analytical risk assessment processes in our coding, we followed Cioffi and Markham (1997) and based our coding on the characteristics of each process (see Appendix B). On the one hand, analytical risk assessment requires thinking before coming up with an assessment. In particular, method-driven analysis requires avoiding assessing risk until a specific tool (e.g., a risk checklist) or technique (e.g., brainstorming about risks in a group) is implemented. Likewise, analysis by deliberation takes time to decompose the problem and assess its various aspects (Dane et al. 2012), for example, the probabilities and impacts of undesired outcomes.

On the other hand, the use of heuristics or expertise-based intuition leads to immediately assessing risks. In particular, an indication of using heuristics is the use of attribute substitution, which means answering a difficult question by answering a similar but easier one (Kahneman and Fredrick 2005). Two ways in which attribute substitution is realized are the representativeness and availability heuristics. The representativeness heuristic bases the risk assessment on the similarity of the present case to past personal experiences (Tversky and Kahneman 1974). The availability heuristic relies on "the ease with which instances could be brought to mind" (Kahneman and Tversky 1982, p. 166) in order to make a judgment. When the availability heuristic is used, the judgments are in accordance with the recalled memories of past experiences, such as the frequency of recalled evidence, its gravity, and its recency (Billings and Schaalman 1980). Relying upon expertise-based intuition is immediate and automatic (Salas et al. 2010) and thus has some similarities with the use of heuristics; yet it encompasses a mental simulation of what might happen based on a complex reasoning logic learned through expertise as well as an affective discharge (Salas et al. 2010). Therefore, as compared to the use of heuristics, using expertise-based intuition is not centered on pattern matching with previous experiences and seeking examples. While it is almost impossible to learn such affective discharge outside lab settings, the use of expertise-based intuition can be traced from providing an immediate risk assessment, having difficulties in explaining the intuition, and attempting to explain the causal chain through which an undesired outcome might occur.

Having separated the use of experiential from analytical risk assessment processes, we drew similarities and differences across responses in search of replicating phenomena and patterns to develop our propositions (Glaser and Strauss 1967; Patton 2002). Since the judgment task of the think-aloud protocol was fixed, the concurrent approach helped mostly with developing propositions about the role of individual characteristics in preferring experiential over analytical risk assessment processes. Nevertheless, the judgments discussed in retrospect would pertain to various cases in which intuition was used and other cases in which analysis was used. Then, there was a search for individual and task (e.g., project and organizational) characteristics that had motivated the use of and reliance upon each. Since the projects and their organizational characteristics varied, it was possible to develop propositions about a wider set of determinants as compared to the propositions derived from the think-aloud protocols.

In this way, we implemented our adopted analytic induction approach by turning the initial model into more specified and situated propositions.

3.5 Findings and Developing Propositions

3.5.1 Tracing Experiential and Analytical Risk Assessment in the Think-aloud Protocols

The verbal response captured in the think-aloud protocol included several instances of the use of experiential methods of risk assessment. Table 3.2 presents some sample quotes.

Table 3.2 Analytical and Experiential Responses - Sample Quotes

Analytical	**Experiential**
18 Codes	15 Codes
Sample Quotes Involving Analytical Risk Assessments	**Sample Quotes Involving Experiential Risk Assessments**
- [No respondent used (or exhibited a preference for using) an explicit tool or technique before assessing the risk] - (PM10) “ERP systems implementation takes long and is iterative. So these people don’t make the project risky. But their resistance on their needed requirements makes it risky. Potentially this is not risky and actually this is good because they are involved in the project.” - (PM13) “Well, immediately, we have a tremendous scope creep that first of all, if we don’t get in under control, we’re really risking this project, and getting out of hand in terms of time and money, so we can talk about scenarios how to resolve this thing but this is very risky and this needs to be addressed immediately.” - (PM15) “Well, it could be risky if... the priorities are not correctly explained.”	- (PM31) “I definitely think this is risky because this is exactly where a lot of these projects go wrong.” - (PM06) “This is 100% risky. [...] let me tell you we have had the exact similar problem in our company... it was a CRM software. The first thing people said was we need change. It has been 6 months and it is not implemented yet.” - (PM09) “High risk. I’ve lived that situation.” - (PM16) “Yes! Because it’s changing the original requirements and it’s adding or changing the functionalities that was agreed upon so it should go through a CR process, so that we can evaluate how it’d impact the delivery and the cost.” - (PM23) “No! Those requirements may make perfect sense. They may add value to the end deliverable.”

3.5.2 Developing the Propositions

The previous analysis showed that project managers rely on both intuition and analysis to find out about a risk and decide upon the risk-response action. Looking at their characteristics, we came to identify constructs that influenced the relative likelihood of reliance on intuition or analysis by the project manager. Emerging patterns in the data suggest that specific factors—pertaining to the individual and task characteristics included in the preliminary specification of determinants—influence the relative use of analytical and heuristic processes of judgment.

By comparing the respondents' demographics and responses, we identified two main patterns linking different characteristics to the use of different processes: formal project management training and project management experience.

Formal project management training: Most project management certifications, for example PMP Certification by the Project Management Institute, promote scrutinizing project risks using careful analysis (PMI 2013). As depicted in Table 3.3, searching for a pattern in their response behavior, we compared the verbal protocols of project managers with or without PMP Certification. Indeed, the identified patterns clearly suggest that the project managers who were PMP certified were most likely to use analytical process and less likely to rely upon experiential processes of risk assessment. Likewise, the project managers without the PMP certification were more likely to assess risk experientially than analytically. The project managers who used an equal mix of the methods were evenly split on having PMP certification or lack thereof.

Table 3.3 The Effect of PMP Certification on the Process of Risk Assessment

	PMP	No PMP
Analytical process was used the most	**8**	2
Both processes were equally used	**3**	**3**
An experiential process was used the most	1	**7**

Moreover, some respondents explicitly mentioned their formal project management training when performing the think-aloud task. For example, when PM13 was presented with the think-aloud scenario and was asked if anything particular came to his mind, he stated:

> Well, you know, just my project management training [...] Okay, anytime we have requirements for a new functionality, on a project of whether if it's just the beginning—if it's just the beginning, then we can have them sit down and discuss what are the solution and the scope, prioritize it and put it in a document and to sign the cost and charter and hand over that to the vendor.

To capture the role of past training, we propose that:

Proposition 1 *Formal project management training (e.g., PMP Certification) encourages the use of analytical risk assessment processes. As these trainings offer the best practices, project managers are usually motivated to apply them. Therefore, the more formal training IT project manager have, the more likely the use of analytical risk assessment processes.*

Experience: According to our initial specification of the processes and their determinants, we were interested in learning about the role of experience on the preference for experiential or analytical risk assessment methods in IT project risk management. We thus categorized our respondents into three equal-sized groups of low, medium, and high experience on the basis of their number of years of IT project management experience. We then looked at the pattern between experience and use of different risk assessment processes in the think-aloud protocols (Table 3.4).

Table 3.4 The Effect of Experience on the Process of Risk Assessment

	Low Experience (Avg. 5.25 Years)	Medium Experience (Avg. 11.75 Years)	High Experience (Avg. 19.6 Years)
Analytical process was used the most	**4**	**4**	2
Both processes were equally used	**3**	1	**2**
An experiential process was used the most	1	**3**	**4**

The data presented in Table 3.4 suggest that the project managers with high experience mainly used the experiential risk assessment processes. Also, the junior project managers were more analytical in their verbal protocol. We observed a similar relationship in the open discussion part of the interviews. While providing reasons why they sometimes use experiential risk assessment processes, some respondents explicitly referred to their experience as a reason for trusting their guts.

Table 3.5 The Role of Experience in the Process of Risk Assessment – Sample Quotes

Experience Motivates the Use of Experiential Risk Assessment Processes
(PM21) "It's based on the past experience. … so with experience you accumulate … and at some point it comes to light oh I have seen [this] …"
(PM18) "When people are more junior they'll rely more on tools. The more senior they get, they'll rely on their guts because of their experience."
(PM09) "I don't know if you cook. The first time you cook, you probably have to follow everything by the recipe, the second time, oh... maybe you shortcut it. And maybe if you've done this 20 times, you don't even look at the recipe anymore and you know it's going to taste good. It's your gut, you know that. And I believe project management, for me, happens the same way. […] after 25 years of being in the IT, you know what to expect. I can't explain it better than knowing this project brings this risks; these are the people in my project and it brings these risks ... and it's just knowledge, what makes you who you are today, it's experience."
(PM13) "Maybe if so far I have done six or seven of this appointments or releases or short-tasks project you know, so I can really manage those tasks without putting anything on the paper."
(PM15) "I have a technical background. And I think it's something that will be risky in some projects to have project managers that do not have technical background. I see this in the job market actually. They are hiring project managers that have technical knowledge, because we have knowledge about what can go wrong and what cannot. It's not just aligning lines and doing Microsoft Project... We can anticipate some problems."

Apparently, "[w]ith sufficient experience, people learn to select proper heuristics from their adaptive toolbox" (Gigerenzer and Gaissmaier 2011, p. 474). This is because experience increases people's subjective sample since "as individuals gain experience, they: (1) have increased general awareness of errors, (2) understand more about errors, (3) are aware of more atypical errors, and (4) have increased knowledge of the causal relationships of errors" (Huff and Prybutok 2008, citing from Tubbs 1992).

High experience, if it leads to higher expertise, makes the project managers more aware of the dynamics of risk inside IT projects. Therefore, the causal chains between risk sources and risk events become clearer to them; and thus, the mechanisms through which risks could materialize in a project becomes vivid to them. To further examine the role of experience in the process of risk assessment in IT projects, we propose that:

Proposition 2: *As the IT project managers' number of years of experience increases, they develop a knowledge of how projects work and a* *subjective sample of what will happen in each project scenario. Recognizing the repeating patterns and assessing what can go wrong becomes easier and more automatic to them. Therefore, the higher the number of years of IT project management experience, the more likely the use of experiential risk assessment processes.*

We also noticed a link between the first two propositions. The three project managers having PMPs who used a mix of experiential and analytical processes as well as the one project manager who mainly used experiential processes were highly experienced project managers (PMs 22, 25, 27, and 30). Therefore, it seems that as one builds his or her own experiences, these experiences may dominate the effect of formal project management training. This observation is somewhat consistent with the finding of Du et al. (2007) that risk assessment tools only influenced risk perceptions of novice project managers but not those of experts.

Perceived cognitive resource demanded by process: IT projects are fast-paced undertakings with limited resources. Among the reasons our respondents referred to why they used a specific process rather than another was the amount of resources required to use the process, especially time and cognitive capacity (Table 3.6).

Table 3.6 The Effect of Perceived Cognitive Resource Demand on the Process of Risk Assessment

Resources Are Available so Analytical Risk Assessment Is Used	Resources Are Not Available so Experiential Risk Assessment Is Used
(PM16) "It's a small projects, a small team, so it's easier for me to do it [updating risk logs] on a weekly basis …"	PM13 "Where there is a limited amount of time, to handle many things and at that point you drop the pen and evaluate it inside your mind."
(PM34) "At the beginning you usually have less pressure, so you are able to say, let's sit down together, let's look at the all possible risk, let's make sure that we understand each one of them, let's rate them, let's also figure out what's the mitigation for all of that… So at the beginning you need to install all that together."	(PM34 Cont'd) "But as the project goes, usually it's more intuition that picks up.… I still want to analyze the situation. Sometimes obviously you don't have the time, you have to cut short at some point, because you don't have the luxury of having infinite time to do the analysis."

As can be seen from the sample quotes, analytical risk assessment is thought to be resource-demanding. Therefore, the use of risk assessment tools and techniques cannot be done without spending much time and effort, for example where multiple undesired outcomes are ensued from risk factors. In this case, experiential risk assessment is more efficient than analytical. This is consistent with prior research suggesting that IT project managers often face time pressure and are under high cognitive load and, thus, may not have time for analytically assessing risks (Kutsch and Hall 2009). Moreover, the software development approach, e.g., Waterfall or agile, can influence the workload of IT project managers; therefore, it can influence the time available to them to perform risk assessments.

To capture the role of perceived cognitive resources required to use a specific risk assessment method on preferring that process, we propose:

Proposition 3 *IT project managers often face resource availability constraints. To allocate the resources, they assign a high priority to the tasks that immediately help with achieving main project objectives rather than more periphery tasks such as risk assessment. Thus, they use the risk assessment method they perceive to be less resource-intensive. Therefore, the lower the relative perceived resource demand by a risk assessment process, the higher the likelihood of its use.*

Perceived process accuracy: Analyzing the data reveals that IT project managers have differing views on the accuracy of experiential and analytical methods (Table 3.7).

Table 3.7 The Effect of Perceived Accuracy on the Process of Risk Assessment

Analytical Risk Assessment Processes Are Used because They Are Perceived to Be More Accurate than Experiential Ones	Experiential Risk Assessment Processes Are Used because They Are Perceived to Be More Accurate than Analytical Ones
(PM12) "Personally I think that, if managers generally learn to instead of thinking about the problems, do the research and see how these problems have been resolved in the past, things will become easier for them.... I personally try to do so."	(PM40) "I had a feeling that they [the provided analyses] weren't really solid. In that case what you want to do is, you want to go and sit down with the users and have a chat, say ok, how do you feel about this, is that right? [...] And then you try to get some evidence, that something is wrong with it. Then tell the leadership […] I know you have signed off, but I have some suspicions that something might not be right, and this is information to back up my suspicions."
(PM31) "I like the idea of going through a database and oh, here's 50 questions and try to answer them about the project. It'll help to identify what all the risks are. […] of course you are going to take prior experience and apply it to whatever is new, that's your advantage; but, I also know my prior experience might not give me the complete picture of what's going forward. […] I will be depending on tools and techniques to maybe, flesh out other risks that I don't see."	(PM22) "The intuition has saved more projects, in my experience, than strictly analytical side. The intuition of me, and the experts, have actually avoid a lot of problems. [...] 80% of stuff [the intuitively identified risks] were true risks."

(PM25) "Checklists might remind you, might stimulate some idea, and they are good things to implement lessons learned to the projects, so the next time other people become aware that that was the problem.	(PM25 Cont'd) If you have a checklist but no experience, it will not be meaningful to you. You will just read the checklist and say hey, this is nothing, this is nothing, this is nothing [...]. At the end of the day, it's your experience."

As it can be seen from the sample quotes, some IT project managers did not believe in the comprehensiveness of the tools and techniques, so they exhibited a preference for relying on their own expertise to cover the different aspects of the situation. This is consistent with the literature suggesting that risk checklists create blind spots about some aspects of projects (Keil et al. 2008).

In contrast, a number of project managers believed that risk assessment tools and techniques had helped them identify some risks they themselves would never have noticed. Therefore, their reliance upon each method depends on their perceived comprehensiveness of the method. This is indeed in line with the normative view that use of risk assessment tools contributes to more accurate perceptions of risk (Keil et al. 2000a). This is also consistent with arguments of dual-process theories of judgment and decision making (Kahneman 2011). For example, Kahneman (2011) suggests that when the analytical process (System 2) senses that the performance of the experiential process (System 1, to be precise) is not adequate, it engages.

Taken together, we suggest that the IT project managers' preference for a certain process of risk assessment over another is influenced by their perception of its relative accuracy.

Proposition 4 *The accuracy in assessing risks matters to IT project managers, as they are responsible for project success. When project managers believe that one specific risk assessment process is more accurate than the other, they exhibit a greater preference for using it. Therefore, the higher the relative perceived accuracy of a risk assessment process, the higher the likelihood of its use.*

Time into project: Another characteristic that we identified as being linked to the use of experiential or analytical methods was the progress in time of a project. Table 3.8 provides examples of the influence of time as identified in the interviews.

Table 3.8 The Effect of Project Time Progress on the Process of Risk Assessment

Analytical Risk Assessment Processes Are Likely to Be Used Early in Projects	Experiential Risk Assessment Processes Are Likely to Be Used During Projects
(PM34) "I would say at the beginning of a project, the analytical portion is probably the best, in the sense that at the beginning you usually have less pressure, so you are able to say, let's sit down together, let's look at the all possible risk, let's make sure that we understand each one of them, let's rate them, let's also figure out what's the mitigation for all of that.	(PM34 Cont'd) But as the project goes, usually it's more intuition that picks up."
(PM19) "I did document them [risks] […] it was identified early on.	(PM19 Cont'd) But it's not a documentation that lived on during the project."

The data suggest that analytical risk assessments are performed mostly at the beginning of projects. It also suggests that the use of experiential processes such as relying on a gut feeling happens during the project, especially towards the project's completion. Together, these factors suggest that time into the project influences the preference for and use of different risk assessment processes.

Many reasons for this pattern can be envisioned. First, risk assessment early in a project is a mandatory task in many project plans. The use of analysis only early in the project has been supported before (Bannerman 2008). Second, early in the project, there is less time pressure. As time goes by, the importance of analytical risk management drops as compared to other activities, such as execution. Third, early on, IT project managers have not developed a nuanced understanding of the project and may thus rely on tools and techniques to understand its risks. As IT project managers gain familiarity with the project and become cognitively overloaded and busy, their risk assessment becomes more experiential. Finally, risk assessment tools and techniques are used infrequently. But as time goes by, things change and risk assessments should be updated. Yet constant maintenance of attention to risk by using tools and techniques is not always feasible. Consequently, experiential risk assessment processes are useful to assess risks as the project changes on a daily basis.

Proposition 5 *As a project progresses, IT project managers gain more familiarity with it. Therefore, analytical risk assessments become less informative to them, and they prefer to focus on other project management activities. Therefore, as a project advances in time, the likelihood of using experiential risk assessment increases.*

Analyzing the data, we learned that sometimes the initial experiential risk assessment processes were complemented with subsequent analytical risk assessment processes. For example, PM30 stated that "… so the first thing is my gut. Then I start investigating, asking questions, collecting facts. So I go toward the analysis." Emerging from our data, two antecedents for following up on the initial experiential assessments with the analytical ones are (1) perceived need to communicate backed-up risk assessments and (2) perceived need for complying with an analytical risk assessment mandate.

Perceived need for evidence-backed-up communication of risk assessments: Sometimes project managers have to communicate risk with other project stakeholders as well as the top management in the organizations. As the data suggests (Table 3.9), it is not always easy to communicate gut feelings; therefore, sometimes there is a need to provide backup evidence before communicating the risk assessments.

Table 3.9 The Effect of Perceived Need for Evidence-backed-up Communicating of Risk Assessments on the Process of Risk Assessment

<table>
<tr><th>High need for evidence-backed-up communication of risk assessments: Analytical</th><th>Low need for evidence-backed-up communication of risk assessments: Experiential</th></tr>
<tr><td>(PM40) "…the only difference is, umm, you cannot go escalating risk based on gut feel, and expect people to believe you.</td><td>(PM40 Cont'd) With a gut feel you don't have any evidence to back you up, other than your credibility … when you have developed enough credibility and you have enough experience under your belt that you can basically get people to buy-in whatever you think it's risky."</td></tr>
<tr><td colspan="2">(PM16) "You need a tool to get everybody else onboard! You can't just go to a meeting and say you know what, this is going to be a risk! I mean everybody can say that.… I list the risky in our weekly meeting in the status slide. And we discuss them at the team meeting. I'm doing it at each team meeting."</td></tr>
<tr><td colspan="2">(PM27) "I do weekly status reports, and risk items are there.... When we have to talk about risks about different levels ... I bring up more about biggest items in this log."</td></tr>
<tr><td colspan="2">(PM30) "[You have to analyse it] ... to bring it to senior management."</td></tr>
</table>

Some project managers mentioned that although they had identified risks experientially and they believed in their assessments, they could not have acted upon them. Therefore, they had to perform an analysis to provide some support for their own assessments.

This is in line with recent research suggesting that one of the key functions of formal risk management practices is to enable better communication of risks with others (de Bakker et al. 2011). This is also consistent with Gigerenzer's (2007) view that rational assessments are made to defend experiential ones, especially when one is legally responsible for some critical decisions.

Proposition 6 *Experiential risk assessments are difficult to communicate with others in organizations. When communicating risk assessments, e.g., with upper management, IT project managers may need to provide evidence for their assessments. The higher the perceived need to communicate an evidence-backed-up risk assessment, the higher the likelihood of using analytical processes.*

Perceived need for complying with an analytical risk assessment mandate: While in some organizations the formal requirements are loose, other organizations try to formalize project management practices to arrive at higher levels of project management maturity (PMI 2013). In such cases, managers have to fulfill an analytical risk assessment mandate.

Table 3.10 The Effect of Perceived Need for Complying with An Analytical Risk Assessment Mandate on the Process of Risk Assessment

High Need: Analytical	Low Need: Experiential
(PM13) "... my initial inclination is to do something, but then my role is constricting me doing this. If we are role players in the organizations, we have to abide by the roles."	(PM10) "In a 100K project, these things [risk assessment tools and techniques] are not required. These are for million-dollar projects. Ten people won't come and analyze probabilities and impacts in small projects, project's work is unstructured teamwork."
(PM13) "I'd rather think myself as a more … rather pragmatic type of person where I will really adapt to the environment … say, policies of the actual customer. […] In my mind there is no sense in doing risk analysis for certain types of projects… [but] I'm looking at it from the perspective of what is the cost/benefit out there? If the cost benefit is that I need to really satisfy the requirements from my supervisors [to do the analysis], then I will do so.	(PM13 Cont'd) And if I do not initially find value in it, and there's not requirement to do it, I probably wouldn't do it."
(PM16) "I used to do it at [the previous company], we used to have a risk management session; we used to	(PM16 Cont'd) Well, we don't do it at [the current company]."

always do that before each tollgate, […] and basically what the risk management was to gather in a room as the project team and we had sticky notes and each team member would list what they felt was the current risk facing the project and we'd put that sticky note on the board and we would give it a value […] we would list them in a spreadsheet. […]	

The interviewed project managers suggested that sometimes analytical risk assessment is enforced through control and governance mechanisms in an organization (Table 3.10). Some project managers felt that they were under pressure to perform risk analysis and that they had to comply with these pressures; therefore, they used risk assessment tools and techniques. Similarly, other project managers suggested that when they are not forced to, they might not use the tools and techniques; instead, they might rely on their own assessments of risk. Therefore, whether it is triggered by experientially perceiving risk or by a specific milestone in the project, project managers will comply with the mandate. This pattern is consistent with the studies suggesting that sometimes IT project managers in search of legitimacy conform to the institutional pressures to follow project management best practices (Mignerat and Rivard 2010).

To capture the role of risk management mandates on the use of analytical risk assessment processes, we propose:

***Proposition** 7* *IT project managers, by definition, try to satisfy key project stakeholders. Some stakeholders, e.g., upper management or the PMO, might establish a mandate for analytical risk assessment. Therefore, the stronger the perceived need to comply with a risk assessment mandate, the more likely the use of analytical risk assessment processes.*

3.6 Conclusions

Our main objective in this study was to uncover why IT project managers prefer using experiential over analytical risk assessment processes. To facilitate this theory-building effort, a conceptual framework specifying the two processes and the motivations behind preferring one over the other was developed by referring to the dual-process theory of judgment and decision making (e.g., Kahneman and Fredrick 2005). Next, a multi-technique qualitative study was used to elaborate some propositions. Following analytical induction (Patton 2002), we first analyzed our data using the conceptual framework that we deductively developed; we then analyzed the data again in search of emerging constructs and relationships. Based on these analyses, we theorized about determinants of the choice of risk assessment processes (tool/method-based or personal assessment).

This paper has a number of limitations. First, distinguishing experiential and analytical processes was performed using a limited number of characteristics of these processes (e.g., referring to experiences, referring to the causal chain from the scenario to an undesired outcome, quickly expressing the assessed risk and then providing a justification for the assessment). Nonetheless, as discussed in the literature review section, these processes differ on a larger number of characteristics (e.g., affective discharge). Future studies can use more of these characteristics. Second, we derived seven determinants of preferring experiential or analytical risk assessment processes. Future research, however, can expand this at least in two ways: The relationship between a combination of the determinants that we identified could be explored (e.g., experience and project management training). Moreover, using other research designs, some additional determinants might be identified. For example, this study used only one think-aloud scenario; nevertheless, by providing hypothetical think-aloud scenarios of various complexity, the effect of complexity on the use of experiential or analytical processes can be explored.

Notwithstanding these limitations, we contribute by broadening our understanding of IT project managers' assessment of risks, in particular, by further identifying the determinants of choosing one process over another. More specifically, the offered propositions expand the existing behavioral studies of IT project risk management (Taylor 2007) by identifying a larger set of the determinants of reliance on analytical processes versus experiential ones.

We believe that experiential risk assessment processes are important elements of mindfulness-based risk management. Kutsch et al. (2012) call for paying some attention to the mindfulness-based view, and this could be beneficial. They suggest that "[i]n principle, mindfulness involves the ability to detect changes in the environment and also take timely action" and one aspect of being mindful is "remaining open and alert to new information" (p. 10). To implement it, "[m]indfulness-based reliability is about managers being encouraged, trained and given sufficient leeway to supplement the prescribed risk processes with situational assessment" (ibid.). We believe that since use of analytical tools and techniques for risk assessment requires a great deal of effort and time, experiential processes can significantly contribute to mainlining situational awareness.

A deep knowledge of the processes through which IS project managers actually arrive at their judgments of the existence of risk and the extent of the project's exposure can contribute to research by explaining the non-use of the tools or lack of trust in their outputs; moreover, it can contribute to practice by helping tailor future risk management training programs and to provide directions for the improvement of risk management methods and practices.

We open several avenues for future research. Future research can test and extend the behavioral propositions developed here. Moreover, using different methods, other experiential processes could be identified. In addition, we looked at experiential and analytical processes dichotomously. Yet project managers—most likely—use a combination of them. On one hand, some might start experientially and then extend and formalize their intuitions analytically. On the other hand, some might analyze, but not experientially internalize their findings.

Another avenue for future research would be to examine the performance of experiential risk assessment processes (Dane et al. 2012) in IT projects. From an objective point of view, experiential processes may be functional in covering the blind spots of risk assessment tools and techniques, especially the generic ones that are not tailored to a given project. Additionally, in the presence of high domain expertise and an immediate materialization timing, experiential processes could outperform effortful analyses. Therefore, future research could take a normative approach and, from an objective point of view, ask: Whether and under what circumstances could experiential risk assessment processes be more advantageous than analytical ones? One such study would be an experiment that would prime one group of project managers to assess risks experientially and another group to assess risks analytically. Then, the performance of the two groups in providing accurate risk assessments would be compared.

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Appendix- Interview Guide

Introduction

- This study is about your project management experience. There are not right or wrong answers. I just want to learn from your experience. So please feel free to respond frankly.

Background

- How long have you worked as a project manager?
- How many projects?
- Do you have a special project management training or certification? When?
- How old are you?
- What was the approximate budget/duration of the largest project that you have ever managed?
- Please tell me about your role in your organization.

Asking for story-telling

- Please focus on the project that you currently manage.
- Please tell me the story of this project.
- Please tell us about the highs and the lows of managing this project.

Role-playing and simulation: Conducting concurrent think-aloud protocols

Questions inspired by Ericsson and Simon (1980); Glöckner and Witteman (2010):

- Please read the following scenarios (scenarios are printed on cards or read over phone) and answer the questions included in them. In doing so, please think and talk aloud about anything that comes to your mind.

Generic probes in think aloud:

- What are you thinking now?
- What was the first thing that came to your mind after reading/hearing this?

Seeded Risk Factor	Tasks
Lost Baggage	**Warm-up Task:** Suppose that you are travelling by a plane. You have checked in some baggage. How likely is it that you arrive at your destination and find out that your checked-in baggage has been lost?
Scope creep	**Main Scenario:** Suppose that you are managing a project that aims to implement an ERP system in your company. You are in the middle of implementing the ERP package in the company. Several managers from different departments in the company keep sending you some requests to customize and change some modules of the ERP. *Do you think this situation is risky?*

Asking for examples

Questions inspired by the critical incident technique (Woolsey 1986):

- Please think of your experience in managing this project as episodes of a movie. Identify and describe an episode when you became stressed or worried over something in this project.
    - o Why were you stressed?
    - o How did you come to realize this situation?
    - o What did you do about it?
    - o Why did you do so?
    - o [Please identify another episode.]
- Please identify and describe an episode in which you realized that a particular risk threatens the project.
    - o How did you realize that?
    - o What did you do about it?

Giving examples and asking for self-evaluation

Questions inspired by "illustrative extreme format", which uses a "prefatory statement" (Patton 2002, p. 366):

- In our past interviews, some project managers told us that they often identify risks by trusting their gut, while others identify risks by deliberating and analyzing them. How about you—which one better corresponds to your way of identifying risks? Please give examples.

Open discussion

- Considering your experience, insights, and organizational processes, which one have you found to be most useful for better seeing the things that can go wrong in a project?

Appendix B: Coding Scheme

Analytical	Experiential
• **Slow:** Providing the assessment of risk only after reasoning • **Effortful, Decomposed:** Talking about probabilities and impacts, talking about the causal chain of events that can lead something to go wrong. • **Serial:** Different aspects of the problem are considered one after another	• **Fast:** Providing an immediate assessment before any reasoning • **Effortless, Holistic:** Referring to first-hand experiences of similar situations instead of attempting to analyze the causal chain of events that can lead something to go wrong. Not decomposing the problem into probabilities and impacts. • **Parallel:** Different aspects of the scenario are considered all at once

Chapter 4
Essay 3: Responding—or Not—to IT Project Risks: Revisiting the Effect of Perceived Risk Exposure

Abstract

Research suggests that sometimes IT project managers' decision to enact—or not to enact—specific risk responses is incongruent with their perceived risk exposure. This paper contributes to theory by developing and testing a model that explains this decision and particularly sheds some light on its relationship with perceived risk exposure. The model proposes that the effect of perceived risk exposure on the risk response decision (conceptualized as the behavioral intention of project managers) is mediated by a subjective counterbalance of expected desired effects and side effects of enacting the risk responses (represented by the overall risk response attitude). It also suggests that the risk response decision is influenced by the pressures project managers perceived for or against enacting the risk responses and by their perception of control—or lack thereof—over the risk response. In developing this model, the paper uses the theory of planned behavior (TPB) as a model-building canvas.

The empirical part of this paper selects three specific risk responses (having user representatives as project team members, appreciating team members' work in a tangible way during the project, and dedicating much effort to planning), instantiates the proposed model for each selected risk response, enriches each instance by populating the belief composites underlying its constructs, and tests each instance using a separate survey.

The results support the core hypothesis on the mediating role of risk response attitude and also its second-order conceptualization for all three instances. Also, perceived pressure added to the explanatory power of the model, and the influence of perceived control was mixed for different instances. The findings stress the importance of the beliefs about specific risk responses on planning to enact them. The methodological contribution of the paper is back to TPB by simultaneously specifying the constructs with belief composites

and reflective measures using MIMIC. Implications for IT project risk management research and practice are discussed.

4.1 Introduction

While the systems delivered by information technology (IT) projects often hold the promise of substantial benefits, project failure can be damaging to organizations, to the point that a failed project can threaten the very existence of a firm (Bloch et al. 2012). From a risk management perspective, this kind of failure occurs when project risks (i.e., threats to project success) are not responded to; therefore, enacting appropriate risk responses (i.e., day-to-day project management activities that have the potential to mitigate project risks) is instrumental in preventing project failure (Barki et al. 2001).

Nevertheless, despite the criticality of risk responses, researchers have observed that project managers' risk response behaviors sometimes differ from the prescriptions in the literature (Bannerman 2008). For example, Taylor (2005) found that project managers did not plan on enacting certain specific risk responses; rather, they consistently added certain contingencies to their projects to cope with risks as they materialized. Such observations have stimulated a growing interest in explaining the risk-response decisions of IT project managers (Keil et al. 2000a; Kutsch et al. 2012). Drawing from models of risk taking (e.g., Sitkin and Pablo 1992), several such studies have explained the variance in risk-response decision via perceived risk exposure and risk propensity (i.e., the tendency to take risks) of project managers (Du et al. 2007; Keil et al. 2000b; Huff and Prybutok 2008).

Nonetheless, while some researchers found that perceived risk exposure significantly influenced the decision to enact specific risk responses (Keil et al. 2000a), some others report that at times risk-response decisions are incongruent with project managers' perceived risk exposure (e.g., Du et al. 2007; Kutsch and Hall 2005; Taylor 2005). Moreover, several studies found risk propensity to have mixed (e.g., Huff and Prybutok 2008) or no effect (e.g., Keil et al. 2000a) on risk response decisions, casting doubt on its explanatory power in the present context.

Motivated by these findings, some researchers have reconsidered the direct influence of perceived risk exposure on risk response intentions and have also included additional antecedents for this decision. For example, researchers have recently examined the reasons for intentionally ignoring risks (Kutsch and Hall 2010) and disengaging from formal risk management practices (Kutsch et al. 2012). Among the identified reasons are the costs of risk responses, the pressures from top management, and the resources required to be influential (Bannerman 2008; Kutsch et al. 2012).

It should be noted that these studies have investigated the application of formal risk management practices but not specific risk responses, conceptually or qualitatively, and thus they did not specify and empirically verify the relationships between the identified determinants. Therefore, there is a need for an integrative model that considers an indirect effect for perceived risk exposure and synthesizes and includes the other antecedents of the decision to enact specific risk responses. The present paper aims to advance the knowledge of the determinants of IT project managers' risk-response decisions by developing and testing such a model.

The model proposes that the effect of perceived risk exposure on the risk response decision is mediated by a subjective counterbalance of expected desired effects (i.e., immediate benefits and risk exposure mitigating effects) and side effects (i.e., immediate costs and risk exposure increasing effects) of enacting the risk responses. It also suggests that beyond this subjective counterbalance of the expected effects, the risk response decision is influenced by the pressures project managers perceived for or against enacting the risk responses and by their perception of control—or lack thereof—over the risk response.

In developing this model, the paper uses the theory of planned behavior (TPB) as a model-building canvas. First, the paper conceptualizes risk response decisions as behavioral intentions (i.e., subjective plans for action—Fishbein and Ajzen 2010) of IT project managers. Moreover, it suggests that the expected desired effects and side effects from enacting specific risk responses are subjectively counterbalanced, forming an overall attitude towards enacting specific risk responses. Using these conceptualizations, the paper offers a model of risk response intentions. At its core, this model leverages the notion of background factors in the theory of planned behavior (TPB, Ajzen 1991) and suggests that the influence of perceived risk exposure on risk response intentions is mediated by overall risk response attitude. The model also includes perceived pressure and perceived control as two antecedents of risk response intention.

Drawing upon TPB provides two benefits. First, given the scarcity of research in the present context, it provides reliable grounds for synthesizing and conceptualizing the constructs identified in past behavioral research on IT project risk management. Second, it offers a way of balancing parsimony and richness in examining the antecedents of risk response intentions by distinguishing overall constructs from their underlying belief composites—i.e., aggregates of 5 to 9 weighted salient beliefs (Fishbein and Ajzen 2010). Therefore, it enables developing a model that is generic enough to study different risk responses and that could be customized to be specific enough to enrich the understanding of one specific risk response. Moreover, it provides cogent theoretical insights about the relationship between the constructs.

The empirical part of this paper comprises three phases that are intended respectively to further specify (Phase 1), enrich (Phase 2), and validate (Phase 3) the proposed model.

Phase 1 instantiated the proposed model for three specific risk responses. It selected one risk response from the three risk response categories of internal integration, external integration, and formal planning (Barki et al. 2001; McFarlan 1981). Using a survey of 29 IT project managers and experts, it sought risk responses that (1) are important for risk mitigation, (2) are not widely practiced in IT projects (although they may have been widely discussed in the literature) because if the risk responses are enacted in most projects then there is no decision to be studied, and (3) are usually within the boundary of control of an IT project manager. The selected risk responses are: having user representatives as project team members (external integration), appreciating team members' work in a tangible way during the project (internal integration), and dedicating much effort to planning (formal control).

Phase#2 enriched the instantiated model for each risk response by developing the belief composites of the principal constructs. Using belief elicitation interviews (Fishbein and Ajzen 2010), the salient beliefs of 24 IT project managers were elicited. The results suggest that the project managers indeed associated each of the specific risk responses with certain desired effects and a number of side effects. They also identified sources of pressure for or against the risk responses and listed factors that would facilitate or inhibit enacting each risk response. On the basis of the identified salient beliefs, the belief composites were populated and added to the models.

Phase#3 validated each of the three instantiated and enriched models by conducting a separate survey of IT project managers (N>107 per risk response, total N=349). The results support the core hypothesis of the proposed model for the three examined risk responses: The relationship between perceived risk exposure and risk response intention is mediated by overall risk response attitude, which is formed by the expected desired effects and expected side effects of enacting the risk response. The results also provide support for the impact of perceived pressure, and provide some support for the role of perceived control.

The main conceptual contributions of this paper are to the behavioral literature on IT project risk management. By suggesting a mediated influence for perceived risk exposure and by considering three antecedents for risk response intention, this paper sheds light on the mixed results in the literature about the enactment of risk responses when risks are noticed (Keil et al. 2000a; Kutsch and Hall 2005). From this model, for example, even if a significant risk exposure is perceived but the attitude towards the corresponding risk response is not positive (e.g., due to not expecting adequate desired effect or expecting substantial side effects), the project manager will be unlikely to decide to enact the risk response. Moreover, even in the presence of a positive attitude towards enacting risk response, pressures from important people or organizational entities could weaken a project manager’s plan to enact specific risk responses. Some influence can also be expected from the lack of resources. This paper also adds to the understanding of the effects of specific risk responses by distinguishing their mitigation effects and side effects; it thus contributes to the recent discussions on the dynamic effects of taking actions against specific risks in IT projects (e.g., Lapointe and Rivard 2010). Moreover, by unpacking these effects into concrete weighted beliefs, it provides a level of richness that would be required for taking further practical actions.

The primary methodological contribution of the paper is back to TPB by introducing the MIMIC approach (Diamantopoulos and Winklhofer 2001) as a way of simultaneously specifying the determinants of intention as reflective constructs and as belief composites.

The paper begins with a brief review of the literature on IT project risk responses and the motivations behind enacting them or the lack thereof. It then describes the proposed research model by defining its constructs and explaining their relationships. This is followed by an explanation of the three phases and the results. The paper concludes with a discussion of the findings and their implications for research and practice.

4.2 Conceptual Background

4.2.1 Prior Research on Risk Responses and Their Link to IT Project Risk

Risk sources (also known as risk factors or risk drivers) refer to threats to project objectives (PMI 2013). The project management activities that aim at eliminating, mitigating, transferring, or controlling such threats are referred to as risk responses (also known as risk resolution techniques, managerial interventions, or risk reduction strategies) (Barki et al. 2001; Charette 1996; Lister 1997; Lyytinen et al. 1998; McFarlan 1981; PMI 2013). For example, in the case of an IT project that exhibits the risk source of scope creep, freezing the requirements is suggested to be an effective risk response to prevent deviations from the project's objectives (Keil et al. 1998).

Risk responses can be planned individually or in batch. In the former case, when a risk source is noticed, a project manager might decide on whether to enact a relevant risk response. Deciding upon individual risk responses usually happens during the course of a project as the emerging risks (Gemino et al. 2008) are identified. In the latter case, risk sources are identified; and then through a rather formalized process, specific responses to them are planned. This batch processing is captured using the notion of risk response planning, which is defined as the process of "formulating and implementing specific actions to address each risk, on a risk-by-risk basis" (Taylor 2006, p. 50). The batch process is often done early on in a project.

Whether risk responses are planned individually or in batch, project managers use certain heuristics to identify which risk response is relevant to which risk source. As Lyytinen et al. (1998, p.237) explain, heuristics "link recognized risky incidents (called in the risk literature risk profiles or risk lists, see Lyytinen et al. 1996) to would-be-effective managerial interventions." Therefore, several normative studies have compiled lists of such heuristics, focusing on identifying "what is the format of rules which map software risk items into risk resolution techniques, i.e. what should one do when a specific incident is observed?" (Lyytinen et al. 1998, p.245). Developing these lists usually begins with using a list of top risk sources and then identifying some specific risk responses for each risk (e.g., Boehm 1991; Lyytinen et al. 1998).

To provide some specificity to this discussion of such heuristics (i.e., mappings of risk sources and risk responses), a representative list was compiled and is presented in Table 4.1 (an explanation of how this list was compiled is provided in Appendix A). For example, as the first row of this table suggests, the risk response of having end-user representatives can alleviate some user risks and some requirement risks. In particular, the literature suggests that it can mitigate the risk of developing wrong functionalities as well as the risk of lacking communication channels.

This list suggests that the relationship between risks and risk responses could be many-to-many: A risk could be reduced by various risk responses, and a risk response might affect various risks. Moreover, the count of the times a specific risk response was included in a study suggests that the literature somewhat agrees that some specific risk responses are relevant to top specific risk sources in IT projects. For example, increasing user participation by having user representatives is commonly discussed across different studies (Boehm 1991; Lyytinen et al. 1998).

Table 4.1 Heuristics: Mapping Risk Responses on Risk Sources

Category		Specific Risk Responses	Count	User risk	Team risk	Requirements risk	Planning and control risk	Technology and complexity risk	Example of Specific Risks Mitigated by the Risk Responses
External Integration (User Participation)		Having end-user representatives	7	×		×			Developing the wrong functions and properties [C, E]; Lack of communication channels [E]
		Making users responsible to do a part of the project.	8	×					Developing the wrong functions [A]; Failure to meet user expectations [H]
		Getting users' formal approval on the work done.	6	×		×			Lack of agreed user acceptance testing and sign-off criteria [B]
Internal Integration	Staffing	Staffing project team with appropriate expertise.	7		×				Personnel shortfalls [B]; Poor or inappropriate beliefs, skills, and experience [E]
	Managing the project team	Keeping project members informed about major decisions.	2		×				Inefficient systems of communication [E]
		Putting every effort to coordinate project team members' work.	3		×				Inefficient systems of communication [E]
		Putting every effort to reduce team member turnover.	3		×				Personnel shortfalls [B] Actor pitfalls: turnover [E]
		Appreciating team members' work in a tangible way during the project.	2		×				Actor pitfalls: non-willing actors [E]
Formal Control	Project Planning	Dedicating much effort to project planning.	6				×		Unrealistic schedules and budgets [A]; Insufficient planning [F]
		Allocating significant resources to estimate project times and budgets.	5				×		Unreasonable project schedule and budget [B]; Systems of work flow: unrealistic schedules [E]
		Using tools such as PERT or CPM to closely follow the project's status.	4				×		Funding and scheduling risks [H]
		Following an appropriate project management methodology.	5				×		Software systems design risks [G]; Lack of a project management methodology [A]
		Getting top management support of the project.	6				×		Inadequate top management commitment [D, H]; Poor leadership [B]
	Managing the Technology Development	Drawing up a formal agreement of work to be done.	5				×		Incomplete requirements [B]; Continuous changes to requirements by client [B]; Not
		Scope freeze	5				×		Gold-plating [C]; Task uncertainty: continuous change [E]
		Incremental development.	6	×			×	×	Funding and Scheduling - Entire project must be budgeted from the outset [H]
		Prototyping.	4			×	×	×	Developing the wrong functions and properties [C]; Pitfalls in technology: new and untried [E]
		Pilot testing.	4	×		×	×	×	Task uncertainty: wrong functions [E]
		Comprehensive testing before going live.	4			×		×	Poor production system performance [B]; Requirements are ignored for the sake of

Table References:

[A] Addison and Vallabh (2002)
[B] Baccarini et al. (2004)
[C] Boehm (1991)
[D] Keil et al. (1998)
[E] Lyytinen et al. (1998)
[F] Nelson (2007)
[G] Sumner (2000)
[H] Tesch et al. (2007)

4.2.2 Prior Research on Explaining Risk Management Behavior

While such lists of heuristics are abundant in the academic and practitioner oriented literature and training programs, the risk response behavior of IT project managers sometimes differs from them. Along these lines, Taylor (2005) has found that

> The risk response planning […] focused almost exclusively on the addition of contingency to the proposed schedule and budget. This differs from the range of possible risk responses recommended in the literature, which includes taking pro-active actions to eliminate or reduce risks that have been identified [...] (p. 441)

Noticing such differences between research and actual practice of risk responses, some researchers have focused on understanding the risk response decisions of project managers. In doing so, and consistent with the above notion of heuristics, a dominant view has been that risk response is decided upon by identifying significant risks. In this view, therefore, the differences between the risk response and what the researchers would expect are due to the fact that project managers perceive risks differently, with risk perception referring to the manager's subjective assessment of probable losses (Du et al. 2007).

Several studies adopting this view have drawn upon models of managerial risk taking (e.g., Sitkin and Pablo 1992; Sitkin and Weingart 1995) and have considered risk perception as the main determinant of the risk response decision. Therefore, a high level of risk perception most likely leads to developing a plan to respond to it. Moreover, on the basis of the adopted models of risk taking, the individual's risk propensity (one's tendency to take or avoid risks—Sitkin and Pablo 1992) also has been included as an antecedent of risk response decisions. The rationale is that a high level of risk propensity makes risks more tolerable; therefore, it will decrease the likelihood of deciding to enact a risk response to cope with them. For example, risk perception and risk propensity constructs have been used to examine the "decision of whether or not to continue with the project", which represents a "choice dilemma between a risky and safe course of action" (Keil et al. 2000a, p. 151).

Nevertheless, the literature reports mixed results about the influence of risk perception and risk propensity on the risk-response decisions of IT project managers. Whereas some studies find significant paths from risk perception to the risk response decision (Keil et al.

2000a), others report limited or no effects. Du et al. (2007, p. 280) found that "the difference in risk perception does not translate into differences in subsequent decisions on how to continue a project." Similarly, Kutsch and Hall (2005) noticed that project managers sometimes intentionally ignore the risk they identify and opt for inaction. Moreover, several studies find that risk propensity has a mixed (e.g., Huff and Prybutok 2008) or no (e.g. Keil et al. 2000a) effect on risk response.

Taken together, these mixed findings suggest that the ability of the models of risk taking to explain a variety of specific risk responses is limited. Therefore, these results motivate reconsidering the impact of perceived risk on risk response decisions, shifting attention away from risk propensity as a main antecedent of the risk response decision, and including other potential antecedents in the provided explanations.

Indeed, a few researchers have taken some steps in this direction. For example, focusing on formal risk management practices, Kutsch and Hall (2005) conclude that risks were ignored not only because one would not believe that risks were real (akin to low risk perception), but also because speaking about them was taboo or was not worth the anxiety it would create (side effects of risk responses). In a similar vein, Kutsch et al. (2012) found that the decision to apply—or not to apply—formal risk management practices was influenced by a variety of project managers' beliefs about the risk management process. Among the identified beliefs are "value", or the belief that "risk management must be demonstrably useful" (p. 7); "legitimacy" or the belief about the "expectation and pressure to conform to the prescribed routine of risk management" (p. 7); and authority, the lack of which has resulted in a common belief that IT project managers were "powerless and had limited authority to act" (p. 9). Likewise, Bannerman (2008) suggests that "specific responses can be formulated according to the circumstances of the project, the threat, the cost of the response and the resources required for the response" (p. 2122). Taken together, these studies have implicitly considered an indirect link between risk perception and risk response, shifted attention away from risk propensity, and introduced additional constructs for explaining the actual behavior of IT project managers. Table 4.2 synthesizes the constructs that were identified in reviewing the past 25 years of behavioral research on IT project risk management.

Table 4.2 A Brief Review of the Determinants of Risk-related Behaviors

Construct	Related Construct	Antecedent to the Activity of	Study
Perceived Risk Exposure	The threat	Formulating specific responses	Bannerman (2008)
	Risk perception	“the managerial choice of whether or not to continue with a project” (p.272)	Du et al. (2007)
	Risk perception	“Decision of whether or not to continue with the project” (p.151)	Keil et al. (2000a)
	Risk perception	“a decision … either to continue with or delay the previously scheduled launch” (p.912)	Keil et al. (2008)
	Unawareness of threats; Distrust in risk estimates	Denying risk; Avoiding risk; Ignoring risk; Delay dealing with risk	Kutsch and Hall (2005)
	The problem of hindsight	“to decide not to actively approach and manage project risks” (p.72)	Kutsch and Hall (2009)
	Fact: The belief that “risks needed to be tangible, perceptible and real” (p.8)	Choice between adherence or disengagement from risk management process	Kutsch et al. (2012)
Expected Desired Effects of Performing the Activity	Being managerially useful	“best practice prescriptions are not being applied in practice” (p.27)	Taylor et al. (2012)
	Risk Exposure Reduction	Implementing risk strategies	Boehm (1989)
Expected Side Effects of Performing the Activity	The cost of the response	Formulating specific responses	Bannerman (2008)
	Side effects of risk management	“Risk taking and escalation” (p.350)	Drummond (1996)
	Risk as a “taboo”	Denying risk; Avoiding risk; Ignoring risk; Delay dealing with risk	Kutsch and Hall (2005)
	The problem of anxiety	“to decide not to actively approach and manage project risks” (p.72)	Kutsch and Hall (2009)
	Competence [acting upon risks is a sign of lack of confidence]	Choice between adherence or disengagement from risk management process	Kutsch et al. (2012)
Counterbalancing Different Effects of Performing the Activity	Value [costs and efforts]	Choice between adherence or disengagement from risk management process	Kutsch et al. (2012)
	Risk-reduction leverage	Implementing risk strategies	Boehm (1989)
	The problem of cost justification	“to decide not to actively approach and manage project risks” (p.72)	Kutsch and Hall (2009)
Pressure for or against the Activity	Power and politics	Risk management	de Bakker et al. (2010)
	Power and politics	“Risk taking and escalation” (p.350)	Drummond (1996)
	Legitimacy [what important others think]	Choice between adherence or disengagement from risk management process	Kutsch et al. (2012)
Ability to Perform the Activity	The resources required for the response	Formulating specific responses	Bannerman (2008)
	Expertise	“the managerial choice of whether or not to continue with a project” (p.272)	Du et al. (2007)
	Lack of expertise; The problem of ownership	“to decide not to actively approach and manage project risks” (p.72)	Kutsch and Hall (2009)
	Authority [who decides?]	Choice between adherence or disengagement from risk management process	Kutsch et al. (2012)
	Ownership of the risk management plan	“failing to follow-up risk management plans prepared [earlier]” (p.437)	Taylor (2005)

This table also synthesizes these constructs into a smaller number of categories. Beyond risk perception and risk propensity, the categories include: the expected desired effects, the expected side effects, the counterbalance of desired and side effects, the pressures for or against enacting the risk response, and the ability of IT project managers to enact the risk response.

These studies as a whole make valuable contributions to our understanding of IT project managers' decision making. Nonetheless, an integrative model that is applicable to examining a variety of risk responses and at the same time provides some explanations for the mixed results mentioned above is still lacking. In the process of developing such a model, a few challenges should be addressed.

First, while the synthesis in Table 4.2 takes an important first step in developing a parsimonious set of pertinent constructs, these constructs need to be clearly defined and adapted to the study of various specific risk responses. This is because the extant literature has explored the determinants (beyond risk perception and risk propensity) chiefly in regard to applying formal risk management practices (e.g., performing the risk identification and analysis processes) but not specific risk responses. Therefore, there is a need for providing formal conceptual definitions (Wacker 2004) for these constructs.

Second, and related to the previous point, the diversity of specific risk responses makes defining the constructs a challenging task. Whereas the formal risk management practices usually have similar structures (e.g., including risk identification, risk evaluation, and risk response planning steps—Kutsch and Hall 2009), specific risk responses could be of significantly different kinds (e.g., freezing requirements as compared to increasing user participation). From this it follows that there is a need for construct definitions that are abstract enough to be applicable to different risk responses and concrete enough not to lose specificity and richness in the explanation of risk response decisions.

Third, the few studies that have explored constructs beyond risk perception and risk propensity (e.g., Kutsch et al. 2012) have mostly sought to identify the reasons from the position of not practicing risk management. Thus, they have not been concerned with specifying the relationships between the identified constructs and empirically testing them. Nevertheless, specifying and examining the relationships would be fruitful for explaining the risk response decisions.

In the next section, a research model is proposed to address these issues.

4.3 A Behavioral Model of IT Project Managers' Risk Response

Figure 4.1 presents the proposed research model of this study. The focal variable of this model is the intention of IT project managers to enact a specific risk response in a particular project (for brevity, risk response intention).

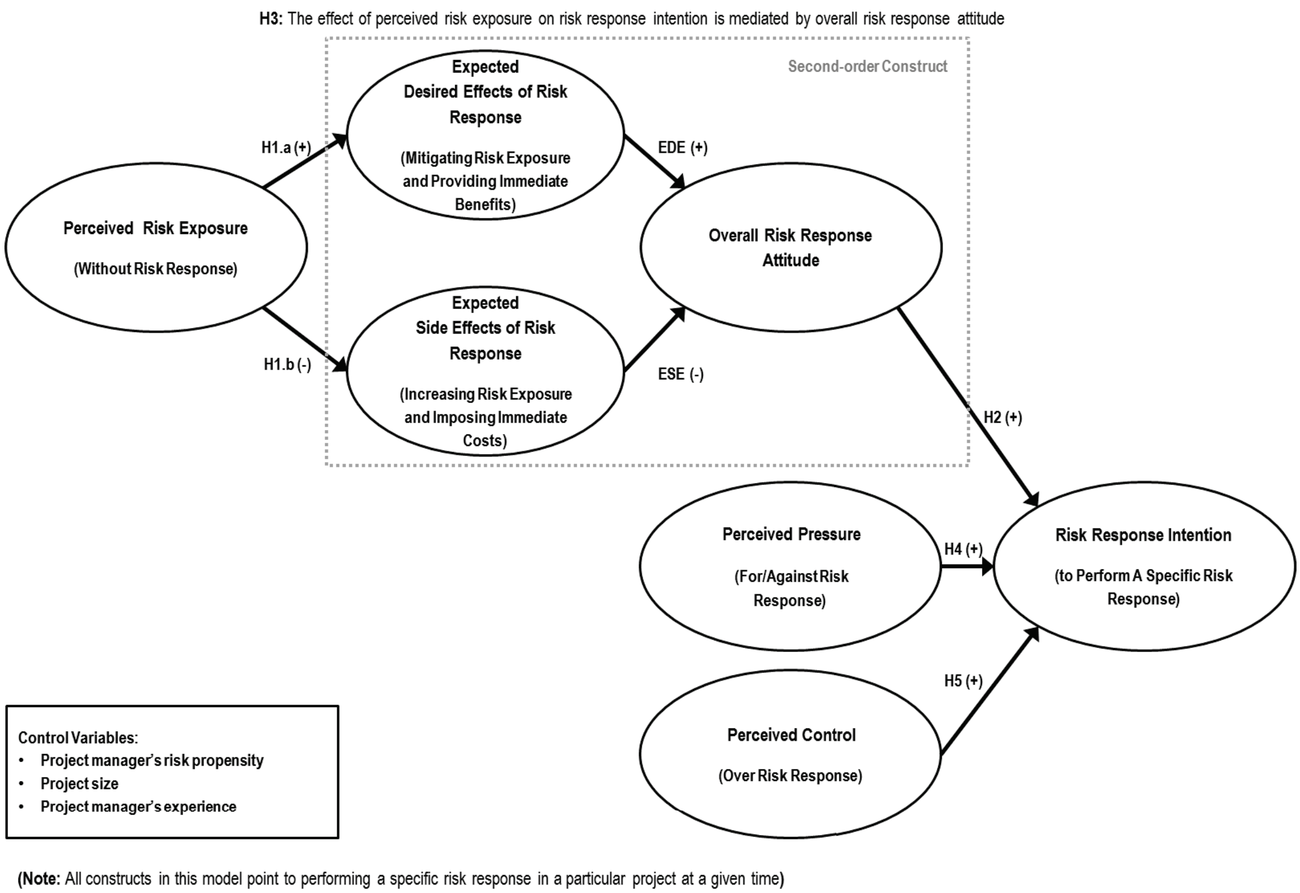


Figure 4.1 A Model of Risk Response Intention of IT Project Managers

At its core, this model posits that the positive effect of perceived risk exposure on risk response intention is indirect, mediated through overall attitude towards enacting the specific risk response in the project (overall risk response attitude). Moreover, the model posits that perceived pressures for or against enacting the specific risk response (perceived pressure) and perceived control over enacting the risk response (perceived control) positively influence the risk response intention.

Below, after a brief explanation of how this model addresses the issues above by leveraging TPB, the constructs included in the research model are conceptualized. Then, the research hypotheses are presented.

4.3.1 Leveraging TPB to Address the Discussed Challenges

This paper addressed the shortcomings and issues in the previous literature by referring to TPB (Ajzen 1991; 2011; Fishbein and Ajzen 2010). In IS, while TPB has been used chiefly to examine adoption and use behaviors (e.g., Pavlou and Fygenson 2006), it is also recommended to be used for explaining other individual-level behaviors (Barki and Benbasat 1996). TPB proved to be a useful theoretical canvas in three ways.

First, the issues with construct clarity can be overcome with the help of TPB. The conceptual nature of TPB constructs—to a large extent—overlap with that of the constructs that were synthesized from the behavioral IT project risk management literature; therefore, the rich definitions in TPB can be leveraged for conceptualizing the constructs of this paper. Moreover, TPB introduced the principle of compatibility as a guideline for conceptualizing constructs (Ajzen and Fishbein 1977). This principle suggests that each behavior can be specified by an *act* that is performed with respect to a *target* in a given *time* and *context*. Then, it argues that the strongest prediction of a behavior can be expected when the antecedents to the behavior are conceptualized in a way that corresponds to each of the other components. Minding this principle, this paper conceptualizes the constructs by focusing them on enacting *a specific risk response* to *certain risks* in *a particular project* during *a given time period*.

Second, the challenge of balancing the specificity/richness of construct definitions for specific risk responses and generalizability/parsimony of the construct definitions across different risk responses can be overcome by learning from TPB, where the constructs are defined at two levels. At the abstract level, TPB defines the antecedents to intention broadly and as a unified whole. Therefore, the conceptualizations are readily adaptable to various definitions. On the other hand, at the concrete level, each construct is conceptualized as a belief composite (i.e., weighted strength of beliefs about the behavior, summed over a set of salient beliefs). As such, each belief composite is unique to the specific behavior it studies.

Third, specifying the relationships between the identified constructs, especially the indirect link between perceived risk exposure and risk response intention, can be facilitated by using TPB as a model-building canvas. In particular, TPB suggests that a person's intention about performing a behavior *reasonably* follows the person's attitude towards performing the behavior, the perceived pressure for or against performing the behavior, and the perceived control over performing the behavior (Ajzen 1991). Moreover, by offering the notion of 'background factors' (see Fishbein and Ajzen 2010, p.22), TPB opens the way for considering how constructs such as perceived risk indirectly affect intention.

4.3.2 Conceptualizing the Constructs

Risk Response Intention: As the notion of risk response planning in the IT project risk management research suggests, IT project managers should first identify risk responses relevant to the noticed risks (e.g., by using heuristics) and then decide on whether they want to enact these risk responses. To define this decision, this study refers to the notion of behavioral intention, i.e., the subjective probability with which one associates himself or herself with doing a behavior (Fishbein and Ajzen 2010). Intention is often seen as a choice decision between the available behavioral alternatives—in the simplest sense, performing or not an action (Ajzen 2011). Minding the principle of compatibility, this paper defines risk response intention as *an IT project manager's subjective probability of enacting—or not enacting—a specific risk response in a particular project during a given time period.* For example, an IT project manager might express a high willingness to freeze project requirements in the middle of a project.

Perceived Risk Exposure: As the review of the literature in the previous section revealed, perceived risk exposure is a key construct used to explain IT project risk-related decisions (e.g., Keil et al. 2000a). In this context, perceived risk is defined as "the belief that there exist sources of risk with potential to adversely affect project outcomes," which "may reflect both the likelihood of various risks occurring and the extent to which they could materially impact project outcomes" (Du et al. 2007, p. 272). This conceptualization of perceived risk, in contrast to the notion of residual risk exposure (El Masri 2013), excludes the effect of managerial activities that might be enacted to mitigate the risk; therefore, it is concerned with the exposure to probable undesired outcomes given that the corresponding risk responses are not performed. Adopting this view, this paper defines perceived risk exposure as *an IT project manager's assessment of the extent to which significant undesired outcomes might happen, assuming that the corresponding specific risk response is not carried out.*

To provide a richer view of this construct, perceived risk exposure (when a specific risk response is not enacted) can be modeled as a belief composite. This belief composite comprises the range of the undesired outcomes the risk response could potentially mitigate and the probability and magnitude of each of these outcomes. More precisely:

$$\text{Perceived Risk Exposure (without a specific risk response)} = \sum_{i=1}^{\substack{\text{Number of salient undesired outcomes}\\ \text{that could have been}\\ \text{mitigated by the specific risk response}}} \boldsymbol{probability}: \textit{Probability of undesired outcome}_i \textit{ to happen} \times \boldsymbol{loss}: \textit{The extent to which undesired outcome}_i \textit{ is harmful for the proejct}$$

It is noteworthy that this model of belief composite for the perceived risk exposure construct assumes an equal weight for the probability and loss dimensions of undesired outcomes. Prior research suggests that loss is more important than probability to IT project managers in their conception of risks (Pablo 1999). Therefore, as an alternative to this formula, the belief composite could be broken down into two instances: one capturing the sum of probabilities and the other capturing the sum of losses due to different undesired outcomes.

Overall risk response attitude formed by expected desired effects and expected side effects: IT project managers associate risk responses with a range of outcomes (Kutsch et al. 2012) that can be categorized into two groups (both from the perspective of IT project managers): desired effects and undesired effects. First, the expected desired effects of risk response refer to *the extent to which an IT project manager anticipates important risks* *would be mitigated if the risk response is enacted*. Such risk mitigation effects could be certain (probability of mitigation effect = 1) or possible (0 < probability of mitigation effect < 1). This aspect of risk responses is consistent with the traditional view that focuses mainly on the personal theories of project managers (i.e., their heuristics) linking risk responses to certain risk mitigation effects (Lyytinen et al. 1998).

To increase the richness of the conceptualization of expected desired effects, the belief composite underlying it could be defined as:

$$\text{Expected Desired Effects} = \sum_{i=1}^{\substack{\text{Number of salient} \\ \text{desired effects}}} \boldsymbol{strength\ of\ belief}: \textit{The probability of the risk response to cause desired effect}_i \times \boldsymbol{evaluation}: \textit{The extent to which desired effect}_i \textit{ is beneficial for the project}$$

For example, a project manager might believe that increasing user participation can very likely reduce the risk of user resistance and evaluate that reducing this risk is very beneficial for the particular project he or she manages. Therefore, this strong belief about reducing user resistance, combined with the extent of benefits of such reduction in the risk of resistance, contributes to stronger expected desired effects for the risk response by the project manager.

Nevertheless, besides its desired effects, enacting a specific risk response could have some side effects, such as imposing costs (e.g., money, effort, time, and social). To capture these undesired outcomes, the expected side effects of risk response are defined as *the extent to which an IT project manager anticipates important risks would be increased if the risk response is enacted*. Such side effects could be certain (probability of side effect = 1) or possible (0 < probability of side effect < 1). The belief composite underlying this dimension is:

$$\text{Expected Side Effects} = \sum_{i=1}^{\substack{\text{Number of salient} \\ \text{side effects}}} \boldsymbol{strength\ of\ belief}: \textit{The probability of the risk response to cause side effect}_i \times \boldsymbol{evaluation}: \textit{The extent to which side effect}_i \textit{ is harmful for the project}$$

For example, increasing user participation, although reducing the risk of user resistance, could cause low project team effectiveness (Heinbokel et al. 1996). If a project manager holds this belief and at the same time evaluates low project team effectiveness to be very harmful, this will contribute to higher levels of expected side effects by the project manager.

So far, two contrasting effects for a specific risk response have been discussed. As the early IT project risk management literature attempts to formalize it, project managers counterbalance (i.e., subjectively aggregate) these effects and form an overall evaluation of risk responses (Boehm 1989; Charette 1996). For example, Boehm (1989) addresses this by using the notion of risk-reduction leverage, defined as the extent to which a risk reduction strategy mitigates risk exposure as compared to the costs of enacting the risk reduction. To conceptualize this counterbalance from a behavioral standpoint, referring to the notion of behavioral attitude in TPB is fruitful. TPB's creation of belief composites for behavioral attitude is rooted in expectancy-value theory (Fishbein 1963), which views a behavior as associated with a range of both positive and negative outcomes. From this point of view, attitude is a sum of the belief that each of these outcomes could occur, weighted by an evaluation of the goodness or badness or each outcome. Therefore, expected desired effects and expected side effects of risk response can be seen as having an attitudinal nature. Behavioral attitude refers to "a latent disposition or tendency to respond with some degree of favorableness and unfavorableness to a psychological object" (Fishbein and Ajzen 2010, p. 76), with the psychological object being performing a behavior.

Adapting this definition, this study defines overall risk response attitude as *the extent to which an IT project manager is predisposed to evaluate performing a specific risk response in a particular project during a given time as favorable or unfavorable*. This construct is a second-order construct formed by the discussed expected desired effects and expected side effects (internal paths are indicated by *EDE* and *ESE* on the research model). In particular, the expected desired effects have a positive influence on the overall risk response attitude, and the expected side effects have a negative one.

It is noteworthy that attitude can be conceptualized and measured from instrumental (i.e. utilitarian) and experiential (i.e., affect-laden) perspectives (Fishbein and Ajzen 2010).

Given the organizational context of enacting risk responses and the agency of project managers on behalf of the organizations, this paper focuses only on the instrumental aspect of attitude.

Perceived Pressure for/against risk response: Consistent with prior research (e.g., Kutsch and Hall 2009), the conceptual territory of this study is bounded by the cases in which IT project managers have the decision-making right and responsibility regarding specific risk responses; however, this does not mean that IT project managers plan risk responses in a vacuum. In the organization of a project, different stakeholders could try to impose their opinions about whether to enact specific risk responses. Moreover, project managers are exposed to what their successful peers do or the certifying bodies (e.g., the Project Management Institute) recommend, and they may be indirectly influenced by them. Therefore, the pressures could be exerted directly as an *injunctive norm* (i.e., what important referents say) or indirectly in the form of a *descriptive norm* (i.e., what important referents do) (Fishbein and Ajzen 2010). TPB broadly captures these pressures as "the person's perception that important others desire the performance or non-performance of a specific behavior" (Ajzen and Fishbein 1980, p.57). Accordingly, this paper conceptualizes the perceived pressure for or against performing a specific risk response as *an IT project manager's perception that important parties or entities desire or recommend performing or avoiding a specific risk response in a particular project*. For example, a project manager might perceive that top management does not expect the development of a working prototype of the system. To increase the granularity of the understanding about different sources of pressure and the importance of each of them, the belief composite underlying the perceived pressure can be conceptualized as:

$$\text{Perceived Pressure} = \sum_{i=1}^{\substack{Number\ of\ salient \\ sources\ of\ pressure}} \boldsymbol{belief}: The\ extent\ to\ which\ source_i\ is\ perceived\ to\ be\ for\ or\ against\ the\ risk\ response \times \boldsymbol{motivation\ to\ comply}: The\ extent\ of\ motivation\ to\ comply\ with\ the\ will\ of\ source_i$$

Perceived Control: The ability of IT project managers to enact specific risk responses could differ. Enacting a risk response might require certain skills, knowledge, and resources, or an uncompromised decision right and responsibility to enact the risk response. TPB suggests that with having or lacking the facilitating factors, such as capacity (i.e., having resources and knowledge required for doing) and autonomy (i.e., having the right), to perform the behavior, enacting the behavior becomes easier or more difficult. It defines the notion of perceived behavioral control as "people's perception of the ease or difficulty of performing the behavior of interest" (Ajzen 1991, p. 183). In this study, perceived control over performing a specific risk response is defined as *an IT project manager's perceived ability to perform a specific risk response in a particular project*. To capture various facilitating factors required for enacting a specific risk response, the underlying belief composite is defined as:

$$\text{Perceived Control} = \sum_{i=1}^{\substack{Number\ of\ salient\\ facilitating\ factors}} \boldsymbol{belief}: Perceived\ probability\ of\ having\ or\ lacking\ the\ facilitating\ factor_i \times \boldsymbol{power}: The\ extent\ to\ which\ the\ facilitating\ factor_i\ is\ perceived\ to\ be\ required\ for\ enacting\ the\ risk\ response$$

For example, for having user representatives—an activity that can respond to the risk of user resistance—a required resource is the availability of such users to represent the others (Damodaran 1996), but an IT project manager might think that this resource is lacking in a particular project.

4.3.3 Developing the Research Hypotheses

The extent to which a project is perceived to be exposed to certain risks—assuming the risk response is not enacted yet—influences the project manager's overall risk response attitude. More precisely, this influence is through the two dimensions of attitude. On the one hand, higher levels of perceived risk exposure will lead to stronger evaluations of the benefits of the mitigation effects of the risk response for the project, as those effects become more important for the project. For example, requirement scrubbing is known to contribute to mitigating the risk of gold plating (Boehm 1991). For a project manager who holds such a belief about requirement scrubbing, a high level of perceived exposure to the risk of gold plating will lead him or her to favorably evaluate the benefits of dedicating managerial efforts to reducing the risk of requirement scrubbing.

On the other hand, by drawing attention to benefits rather than costs, the higher levels of perceived risk exposure will result in weaker evaluations of the extent to which the side effects of the risk response are harmful to that project. For example, consider a project manager who believes that freezing project requirements would lead to reduced customer satisfaction. This project manager would be expected to evaluate this kind of reduction as less harmful when he or she has a strong perception of exposure to the risk of scope creep as compared to when this perception is weak. In other words, in the presence of a strong risk exposure, the side effects of the related risk response become less unfavorable.

To be clear, considering the belief composites underlying the expected desired effects, the main influence of perceived risk exposure on this dimension is by influencing the evaluation of beliefs underlying the dimensions, but not the beliefs themselves. That is, the extent of perceived risk exposure changes the evaluation of how such effects are desirable or not in the project; however, it does not change the association of the risk response with a risk-mitigation power or a risk-increasing effect.

Therefore,

H1 *The stronger the IT project manager's perceived risk exposure, the more positive his or her overall risk response attitude.*

H1.a *The stronger the IT project manager's perceived risk exposure, the stronger the expected desired effects considered for enacting the risk response.*

H1.b *The stronger the IT project manager's perceived risk exposure, the weaker the expected side effects considered for enacting the risk response.*

A positive evaluation of a risk response increases the likelihood for a project manager to plan to enact it. This argument is reinforced by considering the responsibility of IT project managers to ensure project success. In the past literature, the project managers who take risk management actions have been found to be generally positive about the effectiveness of risk management practices (Ropponen 1999). In the same vein, TPB centers on the idea that people's intentions *reasonably* follow their behavioral attitudes (Fishbein and Ajzen 2010). Therefore, the proposed model considers the attitude towards risk response to be a key determinant of risk response intention. Moreover, the evaluated attitudinal beliefs, such as the unjustified costs associated with managing risks, have been found to be among the key motivations behind not applying formal risk management practices (Kutsch and Hall 2009; Kutsch et al. 2012).

Therefore,

H2 *The more positive an IT project manager's overall attitude towards performing a specific risk response in a particular project, the stronger his or her intention to perform that risk response in that project.*

Taking the arguments for H1 and H2 together, this paper proposes the influence of perceived risk exposure on intention to be mediated by attitude towards risk response. In particular, this relationship is mediated because a high perceived risk exposure would motivate risk response only if the risk response is expected to mitigate the action with acceptable side effects. Moreover, risk response attitude can be influenced by a multitude of background factors besides perceived risk exposure. Therefore, even in the presence of higher levels of perceived risk exposure, if the overall risk response attitude is not positive, it is not very likely that an IT project manager will plan to enact the risk response. This argument is also supported by TPB, which suggests that the influence of background factors (e.g., risk perception) is mediated by the principal determinants of intention (e.g., behavioral attitude) (Fishbein and Ajzen 2010). In formal terms,

H3 *The influence of an IT project manager's perceived risk exposure on his or her intention to perform a specific risk response in a particular project is mediated through the project manager's overall attitude towards performing that risk response in that project.*

People are motivated to follow what significant others expect them to do or what they think those others would do (Fishbein and Ajzen 2010). This motivation is intensified for IT project managers who are in an organizational context where a power structure—with predefined superiors and subordinates—is in place. Therefore, aside from how IT project managers personally evaluate enacting risk responses, the pressures they perceive for or against response can influence their behavior. For example, Kutsch and Hall (2009) found that among the reasons IT project managers mentioned for not practicing formal risk management practices were: "Upper management did not think it required it" and there was "No executive call for risk measurements" (p. 79). Therefore, the proposed model suggests that the perceived pressure favoring a specific risk-response action positively influences the behavioral intention; and, conversely, a significant pressure against the risk response will decrease the chances of deciding to do so. In formal terms,

H4 *The stronger an IT project manager's perceived pressure for (or against) performing a specific risk response in a particular project, the stronger his or her intention to perform (or not to perform) that risk response in that project.*

IT projects, like other projects, are temporary endeavors with limited resources; but specific risk responses may require certain resources or knowledge. Therefore, the lack of an abundance of resources on the one hand and the requirement for significant resources on the other hand might make enacting a specific risk response difficult. For example, an IT project manager who thinks that increasing user participation requires a great deal of time slack when such time slack is lacking is likely to decide not to enact this risk response. Given the conditions required for enacting a risk response, and the argument that it is reasonable that people do not plan to do what they believe they cannot do (Ajzen 1991), perceived control over the risk response becomes a direct antecedent to the risk response intention.

H5 *The stronger an IT project manager's perceived control over performing a specific risk response in a particular project, the stronger his or her intention to perform that risk response in that project.*

4.4 Research Methodology

To further specify, enrich, and validate the proposed model, three interrelated phases of empirical research were conducted. *Phase 1* selected three specific risk responses to be investigated. *Phase 2* elicited beliefs about each of the risk responses selected in Phase 1. Building on the composite constructs that were created on the basis of the findings of *Phase 2*, *Phase 3* was a survey to test the research model for each of the risk responses selected in *Phase 1*.

4.4.1 Phase 1: Selection of Risk Responses to Be Investigated

In this phase, the proposed research model was instantiated for three specific risk responses. To select these specific activities, one representative activity from each category of risk response (i.e., internal integration, formal planning, and external integration [Barki et al. 2001]) was identified.

To select the responses, three attributes were considered: importance for risk mitigation, (Keil et al. 1998), the extent of control of IT project managers over risk responses (Keil et al. 1998), and frequency of practice (Addison and Vallabh 2002). To prioritize risk responses to be examined, this study sought responses that are not widely practiced (low-medium frequency) but are important for risk mitigation (medium-high importance) and are within the boundary of control of IT project managers (medium-high control). The responses that are perceived to be not widely practiced are prioritized because if a risk response is enacted in most IT projects, then there is no decision to be made about its enactment. Therefore, it would be more interesting and fruitful to examine antecedents of the not widely practiced risk responses as compared to those of the risk responses enacted in most IT projects.

A survey was designed to present the respondents with a list of risk responses (from Table 4.1) and to ask them to rate each risk response on the dimensions of (a) importance for responding to project risks, (b) the extent of an IT project manager's control over them, and (c) the frequency of use in IT projects (the survey is available in Appendix B). Risk responses were rated on a scale of low-medium-high.

Sixty IT project managers and experts were invited to complete a web survey. Thirty-nine responses were received, 29 of which were complete and useful (response rate 48.3%). Fifty-seven percent of the respondents were IT project managers, the rest were academics with IT project management expertise. Most respondents had 11 to 15 years of experience in the IT project management context.

Risk responses that were rated closer to the desired profile of medium to high importance, medium to high extent of control, and low to medium frequency of practice were kept for analysis. By looking for the minimum Euclidean distance of respondents' ratings from the desired profile, one risk response was selected per category (Table 4.3).

The risk responses best matching the defined profile are: having end-user representatives as project team members (external integration), appreciating team members' work in a tangible way during the project (internal integration), and dedicating much effort to project planning (formal planning). Indeed, each of these risk responses corresponds to certain critical risk sources. Having one or more user representatives can mitigate the risks of lack of adequate user involvement, misunderstanding the requirements, and failure to gain user commitment (Keil et al. 1998). Showing appreciation to project team members in a tangible way during the project to prevent team member turnover and build team morale (Lyytinen et al. 1998). Moreover, dedicating much effort to project planning can mitigate the risk of changing scope/objectives (Keil et al. 1998) as well as unrealistic schedules and budgets (Lyytinen et al. 1998).

Table 4.3 Results of the Risk-response Selection Survey

Category	Risk-response Activity	Importance	Control	Frequency	Euclidean Distance
		Med-High	Med-High	Low-Med	
External Integration	**Having end-user representatives as project team members.**	**100%**	**76%**	**71%**	**0.14**
	Getting users' formal approval on the work done.	93%	86%	64%	0.151
	Having a project champion.	97%	69%	75%	0.16
	Making users responsible to do a part of the project.	90%	66%	75%	0.192
Internal Integration	**Appreciating team members' work in a tangible way during the project.**	**79%**	**97%**	**89%**	**0.055**
	Keeping project members informed about major decisions.	93%	100%	71%	0.086
	Putting every effort to coordinate project team members' work.	97%	97%	64%	0.13
	Staffing project team with appropriate expertise.	100%	72%	75%	0.139
	Putting every effort to reduce team member turnover.	97%	59%	93%	0.178
Formal Planning	**Dedicating much effort to project planning.**	**97%**	**100%**	**78%**	**0.051**
	Drawing up a formal agreement of work to be done.	86%	100%	81%	0.055
	Pilot testing.	100%	79%	86%	0.066
	Incremental development.	93%	83%	82%	0.066
	Using tools such as PERT or CPM to closely follow the project's status.	76%	100%	85%	0.08
	Following an appropriate project management methodology.	93%	97%	71%	0.088
	Scope freeze	90%	72%	93%	0.092
	Allocating significant resources to estimate project times and budgets.	93%	72%	89%	0.092
	Getting top management support of the project.	100%	76%	79%	0.104
	Prototyping.	93%	75%	74%	0.135
	Comprehensive testing before going live.	100%	90%	64%	0.138

Note: The risk responses formatted in bold were selected for further examination.

4.4.2 Phase 2: Developing Belief Composites for Each Selected Risk Response

In this phase, the conceptualization of the principal constructs were enriched by populating their underlying belief composite with modal beliefs and their corresponding weights. Modal beliefs refer to 5 to 9 salient (i.e., readily accessible) beliefs that are common across a representative subset of target respondents (Fishbein and Ajzen 2010).

To identify modal beliefs, a belief-elicitation procedure (Fishbein and Ajzen 2010) about each of the three risk responses was implemented through interviews. By posing open-ended questions (Appendix B), respondents were asked to identify at least 3 beliefs that immediately came to mind when responding to each question.

A convenience sample of 24 IT project managers was used. In creating this sample, the respondents were selected in order to have similar demographics to the population targeted for the survey in Phase 3. They had a mean experience of 12.1 years, 45.8% were PMP certified, and the largest IT project they had ever managed ranged from $100k to $135m, averaging $18.7m. The elicitation of the beliefs of a project manager lasted 15 to 20 minutes per action.

The beliefs were extracted by coding the responses in an open and axial fashion (Strauss and Corbin 1990). Following Ajzen and Fishbein (1980), the beliefs that were observed in more than 20% of the responses were deemed modal. As an exception, the same set of sources of pressure was used for the three risk responses despite their frequency of appearance in the responses. The belief elicitation was continued until saturation was reached.

A modal set of 5 to 9 beliefs was developed for expected desired effects and side effects (Table 4.4), perceived pressure (Table 4.5), and control (Table 4.6) constructs across the three risk-responses. Indeed, the respondents associated each of the selected risk responses with certain desired effects, such as the ability to mitigate project risks. They also associated each risk response with certain side effects, such as increasing exposure to other risks. For example, for the risk response activity of having user representatives, a modal belief about mitigation effects of enacting it was “preventing end-user resistance” (60.0% of respondents) and a belief about its side effects was “leading to leaking of project’s inside information to end-users” (33.3%). Likewise, for showing tangible appreciation to team members during the project, the modal set of beliefs included “preventing project team members’ turnover” (25.0%) and “leading to team members’ feeling they are not being treated fairly” (31.3%). Concerning dedicating much effort to planning, the modal set of beliefs included “providing an estimation of the project schedule and budget” (41.7%) and “leading to producing a detailed work plan likely to change later” (66.7%). The respondents also identified different sources of pressures for/against enacting the risk responses. For example, top management was a frequently mentioned source of pressure. Moreover, for each risk response, some salient factors and circumstances that would facilitate or inhibit enacting the response were extracted.

Table 4.4 The Elicited Effects of Enacting Risk Responses

Activity 1 - Having user representatives as project team members …					
	Desired Effects	**Frequency**		**Side Effects**	**Frequency**
AM_B_1	prevents end-user resistance	60.0% (9 of 15)	AS_B_1	creates conflict between team and end users	40.0% (6 of 15)
AM_B_2	prevents delivering a system with wrong functionalities	60.0% (9 of 15)	AS_B_2	enables end-users introduce personal agendas into system requirements	33.3% (5 of 15)
AM_B_3	prevents producing a not-user-friendly system interface	40.0% (6 of 15)	AS_B_3	permits end-users waste project time on attempts to perfect system functionalities	33.3% (5 of 15)
AM_B_4	prevents project team wasting time deciding about system functionalities	33.3% (5 of 15)	AS_B_4	leads to leaking of project's inside information to end-users	33.3% (5 of 15)
AM_B_5	prevents failure in communicating with the end-user community	33.3% (5 of 15)	AS_B_5	leads to having a team with unnecessary people onboard	40.0% (6 of 15)
AM_B_6	prevents forgetting to address some user requirements	26.7% (4 of 15)			
Activity 2 - Showing tangible appreciation to project team members during project …					
	Desired Effects	**Frequency**		**Side Effects**	**Frequency**
AM_B_1	increases [Low] team members' motivation to continue the work	50.0% (8 of 16)	AS_B_1	leads to team members feeling they are not being treated fairly	31.3% (5 of 16)
AM_B_2	promotes [Low] team spirit	43.8% (7 of 16)	AS_B_2	leads to wasting project time	25.0% (4 of 16)
AM_B_3	improves [weak] relationships among the project team members	25.0% (4 of 16)	AS_B_3	creates conflicts within the project team	25.0% (4 of 16)
AM_B_4	prevents project team members' turnover	25.0% (4 of 16)	AS_B_4	leads to team members' being overconfident about project success thus work less hard	25.0% (4 of 16)
AM_B_5	increases [low] project team members' job satisfaction	31.3% (5 of 16)			
Activity 3 - Dedicating much effort to planning …					
	Desired Effects	**Frequency**		**Side Effects**	**Frequency**
AM_B_1	provides [Lacking] an estimation of the project schedule and budget	41.7% (5 of 12)	AS_B_1	leads to producing a detailed work plan likely to change later	66.7% (8 of 12)
AM_B_2	improves [Low] understanding of the project	66.7% (8 of 12)	AS_B_2	results in wasting time discussing the plan with many people	25.0% (3 of 12)
AM_B_3	enables [not] including risk mitigation activities in the project	41.7% (5 of 12)	AS_B_3	leads to doing an activity that is perceived –especially by clients— as not valuable	25.0% (3 of 12)
AM_B_4	prevents lacking a precise work baseline	58.3% (7 of 12)	AS_B_4	leads to limiting innovation and flexibility by committing to too much detail upfront	33.3% (4 of 12)
AM_B_5	leads to identifying [being unaware of] critical dependencies (e.g., within the project or with	25.0% (3 of 12)	AS_B_5	leads to keeping the project team from doing the actual project work	33.3% (4 of 12)
AM_B_6	prevents deviating from project schedule	50.0% (6 of 12)	AS_B_6	leads to being unable to deliver things soon, especially when there are pressures for it	33.3% (4 of 12)
AM_B_7	prevents not Delivering what was expected	50.0% (6 of 12)			

Table 4.5 The Elicited Sources of Pressure For or Against Risk Responses

The sources of pressure are …		Activity 1		Activity 2		Activity 3	
PP_B_1	your upper management	60%	(9 of 15)	38%	(6 of 16)	58%	(7 of 12)
PP_B_3	your organization's way of doing things (e.g., project management methodology)	27%	(4 of 15)	25%	(4 of 16)	25%	(3 of 12)
PP_B_3	your project team members	0%	(0 of 15)	31%	(5 of 16)	25%	(3 of 12)
PP_B_4	your client/sponsor	33%	(5 of 15)	25%	(4 of 16)	50%	(6 of 12)
PP_B_5	your peer project managers	7%	(1 of 15)	25%	(4 of 16)	33%	(4 of 12)
PP_B_6	the ideal project manager depicted in your past training	20%	(3 of 15)	25%	(4 of 16)	25%	(3 of 12)
PP_B_7	the professional associations you are affiliated with	0%	(0 of 15)	0%	(0 of 16)	33%	(4 of 12)

Table 4.6 The Elicited Factors Facilitating Risk Responses

Activity 1 - Having user representatives as project team members is facilitated by having …							
PC_B_1	the authority to choose the right user representatives.	27%	(4 of 15)	PC_B_5	upper management's explicit support of having user representatives	27%	(4 of 15)
PC_B_2	user representatives who are personally willing to participate.	33%	(5 of 15)	PC_B_6	a budget for having user representatives	20%	(3 of 15)
PC_B_3	someone on the project team who can interact with the user representatives.	27%	(4 of 15)	PC_B_7	an organizational political environment that favors having user representatives	27%	(4 of 15)
PC_B_4	user representatives with some knowledge of IT (its capabilities and limitations) and projects.	40%	(6 of 15)				
Activity 2 - Showing tangible appreciation to project team members during project is facilitated by having …							
PC_B_1	an adequate budget for showing tangible appreciation during the project.	50%	(8 of 16)	PC_B_4	upper management's explicit support of showing tangible appreciation during the project.	25%	(4 of 16)
PC_B_2	some time slack in the schedule to show tangible appreciation during the project.	38%	(6 of 16)	PC_B_5	an organizational culture that favors tangible appreciations (e.g., social gatherings).	31%	(5 of 16)
PC_B_3	the authority to show tangible appreciation during the project.	31%	(5 of 16)				
Activity 3 - Dedicating much efforts to planning is facilitated by having …							
PC_B_1	the ability to foresee the details required for planning ahead.	33%	(4 of 12)	PC_B_5	access to easy-to-use tools for planning.	33%	(4 of 12)
PC_B_2	a proper project scope definition.	33%	(4 of 12)	PC_B_6	upper management's explicit support of dedicating much efforts to planning	42%	(5 of 12)
PC_B_3	access to people —that will be involved in the project—to get their input.	33%	(4 of 12)	PC_B_7	some time slack to spend on project planning.	33%	(4 of 12)
PC_B_4	access to people required to answer questions about project (e.g., technical people, client)	42%	(5 of 12)				

4.4.3 Phase 3: Model Testing

In this phase, the proposed model, instantiated and enriched for each of the three risk responses, was validated. This phase extended knowledge about IT project managers' enactment of risk responses in two ways. First, it investigated how the included constructs can explain risk response intentions. It also examined the mediated effect of the perceived risk exposure construct on risk response intention via the attitude towards risk response. In doing so, it investigated the extent to which the developed belief composites explain the corresponding constructs. Second, it compared the explanatory power of the proposed model to that of a baseline model comprising risk perception and risk propensity (Sitkin and Pablo 1992).

4.4.3.1 Item development

For this phase, a web survey for each instance of the model was developed. The principal antecedents of risk response intention in the research model are attitude, pressure, and control constructs. As discussed above, these constructs can be measured in a direct, reflective way or in a formative way by using belief composites (Fishbein and Ajzen 2010). Recall that a belief composite is *Σ belief* × *weight of belief*, that is, a summation of the strength of 5 to 9 salient beliefs, each weighted by an evaluation (for attitudinal beliefs), motivation to comply (for pressure beliefs), and facilitating power (for control beliefs). Adopting each of the direct or composite measurement approaches has its advantages. While the reflective measures are straightforward and parsimonious, belief composites provide more granularity and richness. In order to retain the benefits of both ways, the MIMIC approach (Diamantopoulos and Winklhofer 2001) was used. Therefore, each construct was measured in both reflective and formative (i.e., belief composite) ways (Figure 4.2).

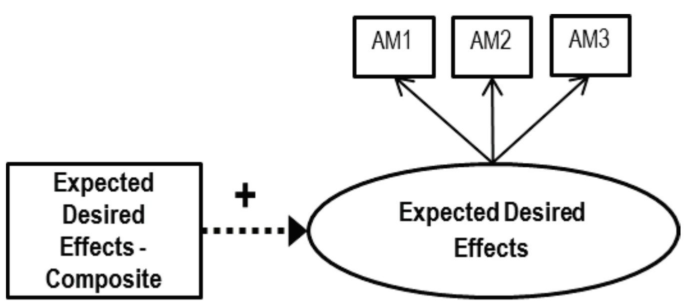


Figure 4.2 A MIMIC Approach to TPB Constructs: Expected Desired Effects

Using the MIMIC approach also helps address concerns about whether the belief composites in TPB should be modeled as antecedents or parts of their corresponding constructs (see Fishbein and Ajzen 2010, p.104). Conceptually speaking, the belief composites are viewed here as having the same nature as their corresponding constructs (i.e., attitude, perceived pressure, and perceived control). For example, an evaluated behavioral belief has the same conceptual nature of the behavioral attitude construct, only at a more granular level. Consequently, considering belief composites as a determinant of their corresponding constructs is not only tautological but also subsumes the variance of the construct and impedes the examination of the influence of other determinants.

The reflective items for attitude towards risk response, perceived pressure, and perceived control were adapted from a standard TPB questionnaire (Fishbein and Ajzen 2010). The items were worded in such a way that they (a) capture the project managers' own beliefs and (b) follow the principle of compatibility (i.e., correspond to a specific action, target of action, context, and time [Ajzen and Fishbein 1977]). The belief composite items were created using the beliefs elicited in Phase#2, with each belief being paired with its corresponding weight. For example, for Activity 1:

Expected Desired Effects - Composite Item$_1$	*= Desired effects belief$_1$ × the evaluation of the desired effect in the particular project* *= Having user representatives in this project will prevent end-user resistance. (Anchors: Very Unlikely/Very Likely; 7-point Semantic Differential Scale)* × *In this project, preventing end-user resistance is... (Anchors: Very Undesirable/Very Desirable; 7-point Semantic Differential Scale)*

Given the conceptualization of the perceived risk exposure construct as containing a belief composite, it was also measured using the MIMIC approach. The reflective items were adapted from the literature (e.g., Keil et al. 2000b). The composite part was created using the set of risk sources and risk events that corresponded to the mitigation effects of the risk response as revealed in Phase#2. Then, the items to measure the probability and undesired impact of such risk factors and events were included. For example, for Activity 1:

Perceived Risk Exposure - Composite Item$_1$	*= The perceived likelihood of the risk event mentioned in expected desired effects belief$_1$ × The undesired impact of this event if it occurs* *= How likely is each of the following to occur in THIS PROJECT? → End user resistance (Anchors Not likely at all/Very likely; on a scale of 0 to 7)* ×

How harmful would each of the following be if it occurs in THIS PROJECT? →
End user resistance (Anchors: Not Harmful at all/Very Harmful; on a scale of 1 to 7)

Moreover, the measure of risk response intention was adapted from Fishbein and Ajzen (2010). Several control variables were also added to the survey, including: risk propensity, experience, project size, and software development approach. Table 4.7 presents how each item was developed.

Table 4.7 Sources of Questionnaire Items

Construct	Source of Reflective Items	Source of Composite
Perceived Risk Exposure	One item adapted with modifications from Keil et al. (2000c). Other items were creating accordingly, informed by a review of perceived risk literature.	Developed to correspond to the outcomes mentioned in the mitigation effects of the risk response.
Attitude towards risk response	Adapted from Fishbein and Ajzen (2010)	Second order construct formed by Attitude – Mitigation Effects and Attitude – Side Effects
Attitude – Mitigation Effects		Developed using elicited beliefs in Study 3
Attitude – Side Effects		
Perceived Pressure		
Perceived Control		
Risk Response Intention		N/A
Risk propensity	Adapted with modifications from MacCrimmon and Wehrung (1990) and Keil et al. (2000c)	N/A
Marker variable – Intuitive decision making in management	Adapted and reduced from Pretz et al. (2014)	N/A

4.4.3.2 Face and content validity

Having populated the initial pool of reflective items, three experts (an IT project manager and two Ph.D. Candidates in IT) were asked to comment on (a) whether the items measure the intended construct (face validity) and (b) whether the items cover the conceptual domain of the provided construct definition (content validity). On the basis of their comments, a few adjustments to the item wordings were made.

4.4.3.3 Card sorting

Next three rounds of card sorting were performed to further check the clarity of the reflective items as well as to perform a preliminary examination of the convergent and discriminant validity of the scales. All of the 12 judges in this exercise were Ph.D. students in IT. In the first round, the items were printed on cards. Neither construct labels nor definitions were provided. Five judges were asked to pile the items into as many categories as desired. The judges exhibited a high level of agreement (Cohen's Kappa 82.1%), and their feedback was used to reword and purify the items for the second round. In the second round, the updated items were posted on a sorting platform on the web (www.websort.net). In addition to the construct labels and definitions, two separate categories to pile unclear or isolated items were included. Three new judges were asked to complete the sorting. A Kappa of 92.0% was reached, and the unclear or isolated items were discussed with the judges to incorporate their feedback. In the third and final round of card sorting, the updated items were posted on the same web platform. Besides construct labels and definitions, no extra category was provided. This forced the judges to sort all of the items under one construct or another. Four new judges completed the task. The non-agreed-upon items were discussed and improved until an acceptable agreement—greater than 0.65 (Moore and Benbasat 1991)—was achieved (Kappa = 84.8%).

4.4.3.4 Ex-ante strategies for minimizing non-response bias

For each of the three risk-response actions, a draft of the web survey was developed using the Qualtrics web application. In doing so, several strategies were adopted to minimize non-response bias (Sivo et al. 2006). Efforts were made to make the web questionnaire respondent-friendly by making it readable, convenient to answer, and as short as possible. Two types of incentives were provided to the respondents. First, a financial incentive was indirectly provided through hiring a data collection company that would pay the respondents who successfully completed the survey. Moreover, at the beginning of the survey the respondents were promised that they would receive personal feedback on some aspects of "their project management profile" upon completion of the survey. In order to provide this feedback, a calculation of the latent variable scores of the risk propensity and managerial intuitiveness constructs was embedded at the end of the web survey, and its results were presented to the respondents upon survey completion (the calculation was based on the item weights obtained in the pilot run). Also, the exact required sample size was calculated and targeted.

4.4.3.5 Ex-ante strategies for minimizing common method bias

Because both dependent and independent variables were measured with the same instrument, efforts were dedicated to reduce the common method variance (CMV) by following the procedural remedies suggested by Podsakoff et al. (2003; 2012) and Sharma et al. (2009). Table 4.8 summarizes the adapted remedies.

4.4.3.6 Ensuring response quality

As mentioned above, the respondents were recruited by hiring the online panel of a data collection company. Web panelists, nonetheless, might exhibit some undesirable response behaviors such as faking their identity, disengaging from questions, speeding, and straight-lining (Gittelman and Trimarchi 2012; Rogers and Richarme 2009). Therefore, to mitigate the risk of such behaviors, several cross-checks were programmed in the survey. Identifying an undesired behavior would raise a red flag. Then, on the basis of the type of red flag, one or a combination of such flags would terminate the survey.

First, to verify respondents' identity, two basic knowledge questions about IT project management were included upfront in the survey (e.g., True or false? SAP is a project risk management software). The survey was terminated if the answers to both questions were wrong. Second, two attention verification questions were included in the body of the survey to assess the engagement with the questions (e.g., If you are still reading this please select "Strongly Agree"). Answering each of these questions differently would immediately terminate the survey. Another attention verification question was also embedded deep in one profile matrix question towards the end of the survey, and missing it would raise a red flag. Third, speeders were flagged by using a minimum survey completion time of 6 minutes, which was considerably shorter than the expected average completion time of 15 minutes determined in the pretests. Finally, straight-liners were flagged according to their response to the profile matrix type questions. These questions were designed in a way that a logically consistent response would take the form of a pattern (e.g., a zigzag) rather than a simple straight line. Moreover, the anchors were often switched and visually highlighted through the use of an appropriate format. Each straight-lining on a profile matrix question would raise a red flag.

Table 4.8 The Procedural Remedies for CMV (Adapted from Podsakoff et al. 2012)

Procedural Remedy	Description	Our Adaptation
Motivate to respond accurately	Cover story included in the instructions	In the instructions section of the survey, respondents were told, please "tell us what you think" and "we need your feedback" (Podsakoff et al. 2012, p. 562)
	Explain how the information will be used	Upfront, respondents were told that they will remain anonymous, the information will be analyzed in aggregate, and the purpose is to help managers to accomplish more successful projects and design more practical risk management practices.
	Promising feedback to respondents by offering a self-understanding	At the beginning of the survey, respondents were promised that they will receive personal feedback on some aspects of their project management profile at the end of the survey.
	Reducing social desirability bias in item wording	Enacting the risk responses was not presented as good and lack of it as bad management. The instructions stated that "there are no right or wrong answers. Just respond based on what is true for you." It also added that: "Because there are different kinds of IT projects, this project management activity might be used in some but not in others."
	Improving scale items to eliminate ambiguity	Efforts were made to avoid using ambiguous terms, asking more than one question using an item, having double-barreled questions. A definition and example of the risk responses were provided.
	Keeping the questionnaire short	Extra constructs and items were removed from the questionnaire.
	Balancing positive and negative items	The elicited beliefs cover both positive and negative outcomes associated with enacting risk response. Although the relative frequency of these outcomes was based on the data of Phase 2, a rather balanced number of such beliefs was included.
Increase the effort required to think about the predictor and criterion at the same time	Temporal, proximal, and psychological separation between predictor and criterion.	A rather long marker variable was put in between the dependent and independent variables, creating some temporal and proximal distance. Since it is theoretically unrelated to the criterion and predictor variables, it also creates some psychological distance. Moreover, some demographic questions were included in the middle of the survey.
	Eliminate common scale properties	Where applicable, different scales were used (e.g., 5-point and 7-point Likert and semantic differential scales). Also different formatting styles (e.g., sliders, bars, and radio buttons) were used in the web survey.
Enable further statistical tests and remedies	Using the marker variable technique	A marker variable, which is a variable within the present context but is theoretically unrelated to the proposed model (Malhotra et al. 2006, p. 1868), was included.

Before survey completion, the respondents raising more than four red flags were redirected to a terminate page provided by the data collection company. Therefore, the completed surveys were deemed usable. The red flag/termination system was tested several times with different response scenarios and by different respondents. According to these tests, the position of the attention verification questions, the number of red flags required to terminate the survey, and the threshold values for straight-lining were adjusted. The results of using this approach to identify undesired behavior are presented in the "Response rate" subsection of this paper.

4.4.3.7 Pretest of the survey

Next, one IT project manager and two experts (a faculty member and a Ph.D. Candidate) were asked to complete the web questionnaire in the presence of the first author and comment on its clarity and form. Using their feedback, some adjustments were made to improve the survey's appearance and flow.

4.4.3.8 Pilot test

In the last step of developing the instrument, a pilot study was conducted (N>50 per each risk response, equaling a total of 152 complete responses) to assess the psychometric properties of the constructs. For the reflective measures, reliability, convergent validity, and discriminant validity were verified. The reflective items with less than desirable psychometric properties were dropped, keeping at least three items for each construct.

For the belief composites, the multicollinearity of the composite items was verified by calculating their VIF in SPSS. The composite items for each construct were regressed on the mean of their corresponding reflective items. The VIF statistics were above the threshold of 3.3 (Peter et al. 2007) for five items and slightly above the threshold of 10 (Hair et al. 2009) for only two of them. Therefore, these items were examined more closely to see if they should be merged, dropped, or kept as is (Peter et al. 2007). After this examination, they were kept because they were not tapping into the same aspect of the constructs. Next, the belief composites were created by summing up their underlying composite items. The correlations of the belief composites with their reflective counterparts were verified. The average correlation for the five composites over the three risk responses was 0.649, which is above the observed value of 0.5 reported by Fishbein and Ajzen (2010).

4.4.4 Data Collection

4.4.4.1 Target population

The target population was project managers who were in charge of managing an IT project at the time of responding. Managing a project at the time of responding would alleviate the recall issues in a study of determinants of behavioral intention. Moreover, the projects they were managing had to have a budget of above $100K.

4.4.4.2 Sample size determination

The required sample size was estimated using two approaches. First, the rule of thumb of 10 times the number of items in the most crowded construct was used (Gefen et al. 2000). The busiest constructs in our model had 7 composite items and 3 reflective ones, totaling 10 items, thus suggesting a required sample size of 100. In the second approach, a minimum statistical power of 80% was sought (Goodhue et al. 2012) by referring to the tables provided by Cohen (1992, p. 158). By specifying a confidence interval of 95%, a medium effect size, and choosing the most complicated multiple regression, a required sample size of 107 was suggested. Taken together, N > 107 useful responses for each of the three risk responses was targeted.

4.4.4.3 Sample

The hired data collection company had a panel of over 30,000 IT managers. The summary profile of the panelists provided by the company suggested a high variance in terms of industries and experience. Therefore, although a non-random sampling approach was used (because the randomly-selected project managers are members of a particular panel), a sample with project managers with a variety of experiences, different types of organizations, various project purposes, and across different studies was expected.

4.4.4.4 Response rate

The data collection company did not store a parameter on whether an IT manager manages a project. Therefore, the company invited approximately 20,000 IT managers to respond to the web survey, and the targeted demographics were verified using screening questions.

The respondents who passed the initial screening questions were randomly assigned to one of the three risk responses (with the exception of not assigning project managers of technical-infrastructure projects to the first activity as the risk response of having user representatives onboard is not relevant to many of their projects). The surveys were kept active until the quota of N > 107 complete responses per activity was reached. After the quota was reached, the survey link was disabled, but those who already had started the survey were allowed to finish it. Out of 20,000 invites, 3,567 potential respondents started the survey. Passing the initial screening questions, 573 respondents continued to the main questionnaire. Among these respondents, 132 missed the first and 53 missed the second attention trap. Moreover, 31 respondents were flagged by their undesirable response behaviors (e.g., speeding or straight-lining), and 8 respondents decided not to continue the survey. This resulted in receiving 349 completed responses, which translates into an incident rate (i.e., completed/started) of 9.8% (= 349/3,567). Out of these 349 responses, 112, 116, and 121 responses pertained to the first, second and third risk responses.

4.4.4.5 Data normality

A Shapiro-Wilk test of normality suggested that the collected data had a non-normal distribution ($p=0.000$ for the reflective items of the principal constructs in the model). To explore this further, the skewness and kurtosis of each reflective item were assessed. No skewness value was found to be higher than the normality threshold of 2 (Ghiselli et al. 1981); however, for some of the items kurtosis values were above 2, up to 5.1 for one perceived control item. Yet, since the kurtosis was still below 7, the data was interpreted as moderately normal (Curran et al. 1996).

4.4.4.6 Non-response bias

Given the unavailability of the demographics of non-respondents, non-response bias was examined by comparing early and late responses (Sivo et al. 2006). T-tests on the means of the principal constructs in our model (perceived risk exposure: $p=0.459$, behavioral attitude: $p=0.364$, perceived control: $p=0.257$, perceived pressure: $p=0.963$, and risk response intention: $p=0.499$) suggested no significant difference between these groups, suggesting that non-response bias is unlikely to threaten the external validity of the findings.

4.4.4.7 *Descriptive statistics*

The characteristics of the project managers and the projects are presented in Table 4.9.

Table 4.9 Descriptive Statistics on Project Managers and Projects

Project Managers

	Activity					
	1		2		3	
Project Mgmt. Experience	**N**	**%**	**N**	**%**	**N**	**%**
Less than 1 year	3	2.7%	1	.9%	4	3.3%
1 to 5 years	29	25.9%	23	19.8%	31	25.6%
6 to 10 years	40	35.7%	51	44.0%	47	38.8%
11 to 15 years	27	24.1%	25	21.6%	24	19.8%
16 to 20 years	9	8.0%	10	8.6%	11	9.1%
21 years or more	4	3.6%	6	5.2%	4	3.3%
Projects Managed						
10 projects or fewer	40	35.7%	33	28.4%	30	24.8%
11 to 20 projects	42	37.5%	52	44.8%	52	43.0%
21 to 50 projects	21	18.8%	21	18.1%	29	24.0%
51 projects or more	9	8.0%	10	8.6%	10	8.3%
Project Mgmt. Certification						
Yes	76	67.9%	80	69.0%	82	67.8%
No	36	32.1%	36	31.0%	39	32.2%
Education						
College / CEGEP	5	4.5%	3	2.6%	7	5.8%
Undergraduate	20	17.9%	29	25.0%	36	29.8%
Certificate/Diploma	39	34.8%	29	25.0%	26	21.5%
Master's / MBA	42	37.5%	49	42.2%	48	39.7%
Ph.D.	6	5.4%	6	5.2%	4	3.3%
Age						
25 years or less	5	4.5%	6	5.2%	8	6.6%
26-30 years	16	14.3%	20	17.2%	20	16.5%
31 to 40 years	55	49.1%	46	39.7%	48	39.7%
41 to 50 years	25	22.3%	34	29.3%	29	24.0%
51 years or more	11	9.8%	10	8.6%	16	13.2%
Gender						
Male	62	55.4%	77	66.4%	80	66.1%
Female	50	44.6%	39	33.6%	41	33.9%
Industry						
Banking, Finance , Insurance	16	14.3%	15	12.9%	9	7.4%
Manufacturing	13	11.6%	9	7.8%	14	11.6%
Health	11	9.8%	9	7.8%	7	5.8%
Government (federal, state, local)	11	9.8%	5	4.3%	9	7.4%
Telecommunications / ICT	10	8.9%	16	13.8%	11	9.1%
Education	9	8.0%	4	3.4%	11	9.1%
Engineering & Management	8	7.1%	17	14.7%	16	13.2%
Retail, Wholesale / Distribution	8	7.1%	10	8.6%	12	9.9%
Business / Personal Services	7	6.3%	10	8.6%	11	9.1%
Other	19	17.0%	21	18.1%	21	17.4%

Projects

	Activity					
	1		2		3	
Core Team	**N**	**%**	**N**	**%**	**N**	**%**
4 people or fewer	12	10.7%	9	7.8%	17	14.0%
5 to 19 people	72	64.3%	74	63.8%	74	61.2%
20 to 49 people	19	17.0%	24	20.7%	19	15.7%
50 people or more	9	8.0%	9	7.8%	11	9.1%
Budget						
Less than $100k	17	15.2%	11	9.5%	13	10.7%
$100K to $1M	57	50.9%	71	61.2%	70	57.9%
$1M to $10M	29	25.9%	30	25.9%	29	24.0%
$10M or more	9	8.0%	4	3.4%	9	7.4%
Duration						
3 months or less	5	4.5%	9	7.8%	8	6.6%
3 to 6 months	25	22.3%	25	21.6%	29	24.0%
6 to 12 months	39	34.8%	42	36.2%	37	30.6%
12 to 18 months	16	14.3%	23	19.8%	18	14.9%
18 to 24 months	19	17.0%	12	10.3%	16	13.2%
24 months or more	8	7.1%	5	4.3%	13	10.7%
Purpose						
Developing and implementing	85	75.9%	88	75.9%	94	77.7%
Configuring and implementing	17	15.2%	16	13.8%	21	17.4%
Rolling-out	10	8.9%	12	10.3%	6	5.0%
Nature (About)						
Technical infrastructure	-	-	30	25.9%	59	48.8%
Business application	63	56.3%	42	36.2%	31	25.6%
Both	49	43.8%	44	37.9%	31	25.6%
Users						
1 to 50	15	13.4%	13	11.2%	10	8.3%
50 too 500	24	21.4%	33	28.4%	26	21.5%
500 to 1,000	21	18.8%	23	19.8%	15	12.4%
1k to 10k	21	18.8%	22	19.0%	36	29.8%
10k to 100k	17	15.2%	17	14.7%	26	21.5%
100k or more	14	12.5%	8	6.9%	8	6.6%
Approach						
Waterfall (or its variants)	27	24.1%	29	25.0%	35	28.9%
Agile (or its variants)	44	39.3%	48	41.4%	41	33.9%
Proprietary methodology	27	24.1%	23	19.8%	24	19.8%
No specific methodology	14	12.5%	15	12.9%	17	14.0%
Other			1	.9%	4	3.3%
Time Progress						
Mean	39		49		43	

Indeed, a high variation in terms of these characteristics was achieved. Moreover, Table 4.10 summarizes the descriptive statistics of this dataset.

Table 4.10 Descriptive Statistics

Construct	Reflective Items	Activity 1 (N=112)				Activity 2 (N=116)				Activity 3 (N=121)			
		Min	Max	Mean	S.D.	Min	Max	Mean	S.D.	Min	Max	Mean	S.D.
Risk Response Intention	RI_1	1	7	5.5	1.6	1	7	6.0	1.1	1	7	6.0	1.3
	RI_2	1	7	5.5	1.6	1	7	6.1	1.2	1	7	5.9	1.4
	RI_4	1	7	5.6	1.5	1	7	6.1	1.0	1	7	6.0	1.3
Perceived Risk Exposure	RPRE_2	1	7	4.8	1.6	1	7	4.6	1.7	1	7	5.3	1.7
	RPRE_4	1	7	4.5	1.8	1	7	4.1	1.8	1	7	5.1	1.8
	RPRE_5	1	7	4.9	1.5	1	7	4.6	1.7	1	7	5.1	1.7
Expected Desired Effects	RAM_1	1	7	5.3	1.4	1	7	4.9	1.5	2	7	5.8	1.2
	RAM_3	1	7	5.1	1.5	1	7	4.8	1.6	1	7	5.6	1.2
	RAM_4	2	7	5.7	1.2	1	7	5.2	1.5	2	7	6.0	1.1
Expected Side Effects	RAS_2	1	7	4.3	1.6	1	7	3.4	1.8	1	7	3.8	1.9
	RAS_3	1	7	4.0	1.7	1	7	3.4	1.8	1	7	3.7	1.9
	RAS_4	1	7	3.9	1.8	1	7	3.4	1.8	1	7	3.5	2.0
Overall Risk Response Attitude	ROA_1	3	7	6.0	1.2	1	7	6.3	0.9	2	7	6.3	1.1
	ROA_2	2	7	5.9	1.3	1	7	6.0	1.2	2	7	6.2	1.1
	ROA_4	1	7	5.7	1.4	1	7	6.1	1.1	1	7	6.1	1.1
Perceived Pressure	RPP_2	1	7	5.3	1.3	2	7	5.4	1.2	2	7	5.7	1.3
	RPP_3	1	7	5.2	1.5	1	7	5.5	1.3	2	7	5.6	1.3
	RPP_4	1	7	5.2	1.4	1	7	5.3	1.3	2	7	5.5	1.3
Perceived Control	RPC_1	2	7	6.1	1.0	4	7	6.4	0.7	1	7	6.1	1.2
	RPC_2	3	7	6.2	0.9	2	7	6.3	1.0	1	7	6.1	1.2
	RPC_3	1	7	6.0	1.2	4	7	6.4	0.8	2	7	6.1	1.2
Risk Propensity	RiskPro_1	1	5	3.4	0.8	2	5	3.7	0.7	1	5	3.6	0.9
	RiskPro_2	1	5	3.5	0.9	1	5	3.7	0.9	1	5	3.6	1.0
	RiskPro_3	1	5	3.4	0.9	1	5	3.7	0.9	1	5	3.6	0.9
Construct	**Belief Composite**												
Perceived Risk Exposure	PRE_X_AVG	0.0	38.2	12.4	8.8	0.0	35.6	9.3	8.4	0.0	43.1	10.7	8.1
Expected Desired Effects	AM_X_AVG	8.0	49.0	30.5	8.8	13.0	49.0	36.1	7.5	5.1	49.0	33.1	7.9
Expected Side Effects	AS_X_AVG	1.0	43.4	19.5	9.8	0.0	37.8	13.9	9.0	3.2	43.2	17.8	9.1
Perceived Pressure	PP_X_AVG	-3.7	19.0	7.3	5.1	-8.6	21.0	8.5	5.4	-4.3	21.0	7.9	4.7
Perceived Control	PC_X_AVG	8.6	49.0	34.4	7.2	11.0	49.0	33.0	7.3	14.9	49.0	33.4	7.7

4.4.5 Data Analysis

4.4.5.1 Approach

The data was analyzed using Smart-PLS 2.0 (Ringle et al. 2005). PLS was chosen for four reasons. First, the main objective of this study is to build theory, and PLS is an appropriate choice to this end (Gefen et al. 2011; Gefen et al. 2000). Second, the distribution of the data was only moderately normal, casting doubt on the appropriateness of covariance-based structural equation modeling (CB-SEM) (Gefen et al. 2000). Third, belief composites have a formative nature, thus using PLS would enable analyzing them even without the MIMIC approach. Furthermore, given the focus of this study on three different risk responses and thus running three separate models, the sample size per risk response was fairly small, and PLS could be useful in this regard. (For CB-SEM, a larger sample size, at least 350 responses per risk response, would have been needed.)

4.4.5.2 Common method bias

Despite the adopted ex-ante strategies, common method bias could still threaten the validity of the findings of this study. Therefore, the influence of this bias was tested from three different approaches. First, a Harman's single factor test was performed using principal component analysis with no rotation (see Podsakoff and Organ 1986). As Table 4.11 presents, for all the three risk responses, the first component did not "account for the majority of the covariance among the measures" (Podsakoff et al. 2003, p.889). Moreover, the fact that the second component for each risk response also explains a considerable portion of variance in the data further questions the existence of a significant common method variance, where "a single factor will emerge from the factor analysis" (Podsakoff et al. 2003, p.889).

Table 4.11 The Results of Harman's Single Factor Test

Risk Response	Number of Components with Eigenvalues Above 1	Variance Explained by The First Factor	Variance Explained by The Second Factor
Activity 1	7	35.5%	10.7%
Activity 2	8	23.4%	17.9
Activity 3	8	31.0%	13.7%

Second, the cross correlation of the constructs in the model were examined. The highest correlation was 0.76 (between a direct measure of overall risk response attitude and a measure of its expected desired effects dimension), which is below the threshold of 0.9 (Pavlou and El Sawy 2006; Siponen and Vance 2010). Third, the procedure suggested by Rönkkö and Ylitalo (2011)—which adapts the procedure of Lindell and Whitney (2001) to PLS—was implemented. Initially, the mean correlation of the measured marker variable items with all other items in the model was compared with the recommended threshold of 0.05 (Rönkkö and Ylitalo 2011). This correlation was 0.003, 0.105, and 0.174 for the three risk responses respectively. Therefore, the analysis was continued to the next step, where the measured marker variable was included as an antecedent to all of the endogenous constructs in our research model (Rönkkö and Ylitalo 2011). Doing so did not change the significance or insignificance of any of the paths, suggesting that common method bias does not influence the results of the hypothesis testing. Thus, it was deemed unnecessary to partial out the effect of marker variable or a method factor (Rönkkö and Ylitalo 2011).

4.4.6 Results: Measurement Model

4.4.6.1 Validating the reflective measures

For the reflective constructs, reliability and convergent and discriminant validity were assessed (Table 4.12). The reliability statistics of all constructs were satisfactory, with all having a composite reliability above 0.793, which is greater than the recommended threshold of 0.7 (Esposito Vinzi et al. 2010; Gefen et al. 2011), and a Cronbach's alpha above 0.692, which is above the acceptable value of 0.6 for a theory building effort (Nunnally 1967).

Moreover, all constructs exhibited a satisfactory level of convergent validity. The value of AVE for all constructs was higher than 0.5 (Gefen et al. 2000). Moreover, all items had a weight of 0.7 or higher, except for one item that had a weight of 0.629 (Act 1, Perceived Control item 1). Given the very low weight of this item on other constructs, it was deemed appropriate to keep this item.

Finally, all measures had an acceptable level of discriminant validity. First, the square root of the AVE of each construct was greater than the maximum cross loading with the other constructs (Gefen et al. 2000). Moreover, the loading of each item on its intended construct was at least 0.1 higher than the maximum cross loading of the item with the other constructs (Gefen and Straub 2005).

Table 4.12 Validating the Reflective Measures in the Main Survey

		Risk Response	Perceived Risk Exposure	Attitude - Mitigation Effects	Attitude - Side Effects	Overall Attitude	Perceived Pressure	Perceived Control	Risk-response Intention
			Construct						
Reliability	Composite Reliability	Act 1	0.905	0.920	0.912	0.935	0.909	0.793	0.950
		Act 2	0.931	0.926	0.949	0.858	0.890	0.906	0.871
		Act 3	0.944	0.918	0.928	0.956	0.914	0.904	0.913
	Cronbach's Alpha	Act 1	0.843	0.869	0.854	0.896	0.850	0.692	0.920
		Act 2	0.889	0.879	0.919	0.754	0.823	0.847	0.779
		Act 3	0.911	0.867	0.903	0.932	0.861	0.842	0.856
Convergent Validity	AVE	Act 1	0.760	0.792	0.775	0.827	0.769	0.566	0.862
		Act 2	0.819	0.806	0.860	0.669	0.730	0.764	0.693
		Act 3	0.848	0.789	0.812	0.879	0.781	0.759	0.777
	Min (Item Weight)	Act 1	0.855	0.867	0.823	0.895	0.826	0.629	0.911
		Act 2	0.885	0.844	0.909	0.781	0.772	0.860	0.804
		Act 3	0.910	0.882	0.852	0.934	0.865	0.801	0.842
Discriminant Validity	Sqrt (AVE) - Max (Construct Cross Correlation)	Act 1	0.162	0.132	0.122	0.152	0.215	0.290	0.235
		Act 2	0.252	0.244	0.274	0.207	0.443	0.473	0.222
		Act 3	0.276	0.244	0.256	0.269	0.348	0.435	0.213
	Min (Difference in the Items' Cross Weight)	Act 1	0.190	0.725	0.261	0.208	0.339	0.275	0.193
		Act 2	0.288	0.609	0.304	0.224	0.486	0.434	0.301
		Act 3	0.298	0.743	0.269	0.290	0.479	0.396	0.311

4.4.6.2 Validating the belief composites

To validate the belief composite constructs, first the composite items were calculated. To do so, the strength of each belief was multiplied by its weight (i.e., the evaluation of belief in the case of attitudinal beliefs, motivation to comply in the case of pressure beliefs, and power of facilitating factor in the case of pressure beliefs). The multicollinearity of the composite items was then verified in SPSS. By regressing the composite items on the mean of the related reflective items, VIF was computed. As with the pilot results, multicollinearity was not an issue: only two composite items had a VIF of 3.52 and 3.57, which are slightly larger than the threshold of 3.3 (Petter et al. 2007). These items, being generated by a belief elicitation procedure in Study 2, were kept to preserve the content validity of the belief composites.

Next, the constructs were modeled according to the MIMIC approach by using PLS in Mode C (see Petter et al. 2007, p. 642). In this approach, the formative part is included as a determinant of the reflective part of the construct. In order to create the composite constructs out of these composite items, the average value of the composite items was calculated (Fishbein and Ajzen 2010).

The path between each belief composite and the corresponding reflective construct was then examined. The average correlation was 0.434, which is close to the average value of 0.5 observed over the past 30 years in reasoned action research (Fishbein and Ajzen 2010). This path is significant for all constructs (Petter et al. 2007), but the variance explained by the perceived risk exposure composite is very low. Table 4.13 summarizes the statistics on belief composites.

Table 4.13 Examining the Validity of the Belief Composites

	Max VIF of Composite Items			Path (T-value) between Composite and Reflective Parts						R-squared of the Reflective Part		
	Act 1	Act 2	Act 3	Act 1		Act 2		Act 3		Act 1	Act 2	Act 3
Construct				Path	t-value	Path	t-value	Path	t-value			
Perceived Risk Exposure	2.66	3.52	3.57	0.250	4.56	0.228	5.06	0.153	3.83	6.3%	5.2%	2.4%
Expected Desired Effects	2.34	2.40	2.28	0.381	7.61	0.475	11.23	0.702	21.73	14.5%	22.6%	49.2%
Expected Side Effects	1.94	2.35	2.06	0.438	8.76	0.491	11.28	0.552	12.72	19.2%	24.1%	30.5%
Perceived Pressure	2.26	2.52	1.86	0.615	18.07	0.564	13.24	0.414	7.72	37.9%	31.8%	17.2%
Perceived Control	1.88	1.96	1.86	0.443	9.33	0.389	8.28	0.413	9.54	19.6%	15.1%	17.1%

4.4.6.3 Validating the second-order construct of attitude towards risk response

On the basis of theory, the overall risk response attitude was conceptualized as a second-order construct formed by the two dimensions of expected desired effects and expected side effects. This conceptualization was implemented in PLS via two approaches. In the first approach, the Model (a) (Figure 4.3) was run in PLS. Both dimension paths were significant and in the expected direction for the three activities.

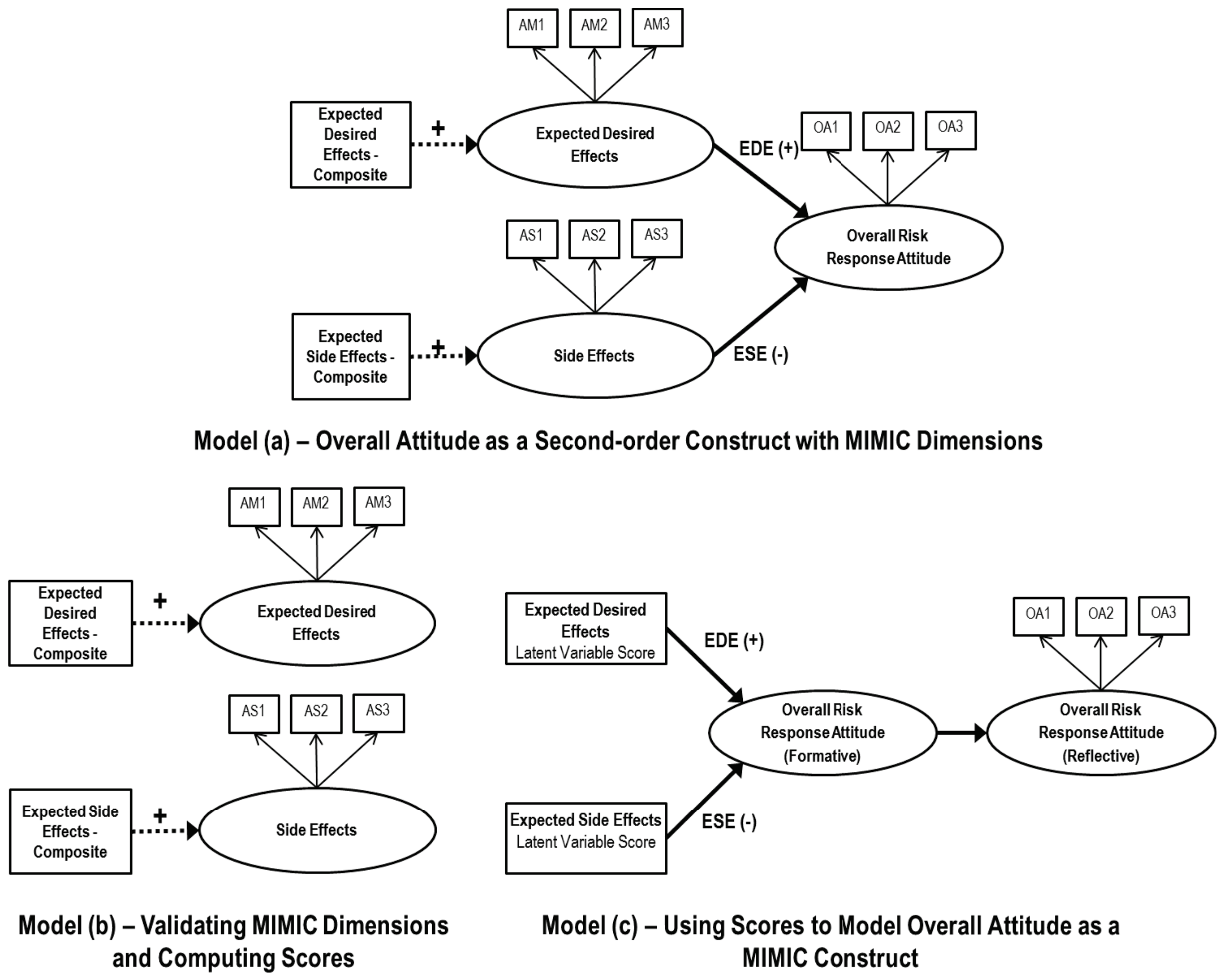


Figure 4.3 Implementing the Second-Order Model of Attitude towards Risk Response

In the second approach, the analysis was performed in two steps: Models (b) and (c). By running Model (b), the factor score of each dimension was computed to use it for further analysis (Lowry and Gaskin 2014). Then, given the existence of direct reflective measures of the attitude towards the risk response construct, this construct was modeled following the MIMIC approach in PLS Mode C. More precisely, as illustrated in Model (c), the computed factor scores were used as two formative measures composing the formative part, and the three reflective items were used for the reflective part of the construct. The VIF of the two items in the MIMIC approach was verified by regressing them on the mean of the overall risk response attitude items, and multicollinearity was not an issue. Both item weights—paths EDE and ESE in Model (c)—were significant and in the expected direction for the three activities. The two approaches produced statistically identical results (Table 4.14).

Table 4.14 The Second-Order MIMIC Model of Attitude towards Risk Response

	Activity 1				Activity 2				Activity 3			
	Model (a)		Model (c)		Model (a)		Model (c)		Model (a)		Model (c)	
Path	Path	t-value	Path	t-value	Path	t-value	Path	t-value	Path	t-value	Path	t-value
Expected Desired Effects (EDE)	0.736	18.24	0.963	44.49	0.423	7.05	0.910	13.24	0.607	12.13	0.987	47.46
Expected Side Effects (ESE)	-0.092	2.28	-0.120	2.21	-0.353	7.98	-0.759	8.67	-0.120	2.81	-0.195	2.53
MIMIC Correlation	N/A		0.764	24.40	N/A		0.464	8.29	N/A		0.615	14.24
Ovearll Risk Response Attitude - R^2	58.30%		58.30%		21.60%		21.60%		37.90%		37.90%	

4.4.7 Results: Structural Model

4.4.7.1 Analyzing the model

In accordance with recent studies (e.g., Keil et al. 2013), a step-by-step approach was used to test the models in PLS (Table 4.15). For each risk response, 3 models were examined. First, in Model 1, only the control variables were included. Then, in Model 2 (both a and b variants), both TPB constructs were added to the analysis. Lastly, in Model 3 (both a and b variants), the perceived risk exposure construct was added as an antecedent to the attitude towards risk response construct. In terms of measurement, variants *a* (Models 2.a and 3.a) used only the reflective items, and variants *b* (Models 2.b and 3.b) used the factor scores that were derived from the MIMIC approach.

Given the addition of the principal determinants of risk response intention over the control variables, a significant added effect from Model 1 to Model 2 was expected. Yet, between Models 2 and 3, no antecedent to the focal variable was added; and therefore, no significant change in its explanation was expected. Moreover, the *a* and *b* variants of each model differ only on the richness they provide in understanding what constitutes the construct but not on their relationship with each other; therefore, no significant change in the explanation of the risk response intention or in the significance of the other paths in the model was expected.

It is noteworthy that the overall risk response attitude in Model 3.b (MIMIC model of attitude and perceived risk exposure as its antecedent) is an endogenous formative construct. More precisely, the attitude towards risk response is formed by its dimensions, and its dimensions are formed by composite items. Thus having the perceived risk exposure as their antecedent makes them endogenous formative constructs, a practice that has been recently debated (Aguirre-Urreta and Marakas 2013; Rigdon et al. 2014). The rationale of this debate is the fact that, by definition, the formative measurement items are supposed to cover all of the causes of a construct; thus, besides its formative items, no other antecedents for the construct could be envisioned. To overcome this concern, this study used a two-stage analysis. First the latent variable scores of the attitude construct were calculated using MIMIC, then the scores were used for the path analysis. In this way, the formative (composite items) part is the only part that *constitutes* the construct and subsumes the variation in the reflective part of the construct. Then, putting an antecedent to the latent variable scores explains the *cause* of such variance, i.e., explains why such variance in the construct exists in the first place.

Table 4.15 Results of Step-by-Step Model Analysis

	Act 1					Act 2					Act 3				
	M1	M2a Ref	M2b MIMIC	M3a Ref	M3b MIMIC	M1	M2a Ref	M2b MIMIC	M3a Ref	M3b MIMIC	M1	M2a Ref	M2b MIMIC	M3a Ref	M3b MIMIC
Control Variables															
Risk propensity	-0.042	-0.101	-0.109	-0.103	-.0109	-0.003	-0.056	-0.048	-0.056	-0.048	0.166	0.071	0.075	0.071	0.075
	(1.034)	(2.718)	(2.529)	(2.631)	(2.682)	(0.056)	(1.070)	(0.905)	(0.997)	(0.871)	(3.050)	(1.807)	(2.000)	(1.729)	(1.875)
Project size	0.259	0.050	0.040	0.050	0.040	0.167	0.020	0.026	0.020	0.026	0.181	0.154	0.153	0.154	0.153
	(4.948)	(1.232)	(1.038)	(1.246)	(0.986)	(3.609)	(0.489)	(0.656)	(0.484)	(0.633)	(3.805)	(4.418)	(4.410)	(4.667)	(4.487)
Project Manager's experience	0.263	0.128	0.140	0.127	0.140	0.265	0.056	0.075	0.057	0.078	-0.135	-0.156	-0.156	-0.156	-0.156
	(5.752)	(3.147)	(3.317)	(3.065)	(3.670)	(3.887)	(1.024)	(1.324)	(1.048)	(1.369)	(1.825)	(3.2690)	(3.171)	(3.316)	(3.181)
Main Effects															
H2: Overall Risk Response Attitude		0.449	0.451	0.443	0.451		0.573	0.544	0.563	0.544		0.532	0.539	0.532	0.539
		(7.444)	(6.786)	(7.354)	(6.807)		(9.710)	(8.583)	(9.299)	(8.870)		(10.247)	(10.624)	(10.947)	(11.086)
H4: Perceived Pressure		0.297	0.318	0.303	0.318		0.234	0.200	0.233	0.200		0.138	0.123	0.138	0.123
		(4.263)	(4.256)	(4.174)	(4.144)		(4.316)	(3.609)	(4.320)	(3.361)		(3.113)	(2.767)	(3.018)	(2.811)
H5: Perceived Control		**-.025**	**-0.074**	**-0.024**	**-0.074**		-0.132	**-0.108**	-0.126	**-0.108**		0.143	0.145	0.142	0.145
		(0.703)	**(1.868)**	**(0.695)**	**(1.830)**		(2.141)	**(1.850)**	(2.185)	**(1.867)**		(2.868)	(3.072)	(2.842)	(2.976)
Other Effects															
H1: Perceived Risk Exposure → Overall Risk Response Attitude				0.582	0.570				0.165	0.184				0.460	0.458
				(14.445)	(13.021)				(3.273)	(3.269)				(8.342)	(9.486)
H1.a: Perceived Risk Exposure → Expected Desired Effects				0.710	0.698				0.653	0.633				0.645	0.643
				(22.336)	(19.982)				(15.185)	(13.184)				(16.483)	(16.120)
H1.b: Perceived Risk Exposure → Expected Side Effects				**-0.120**	**-0.114**				0.273*	0.272*				-0.096	**-0.068**
				(1.899)	**(1.912)**				(4.686)	(6.176)				(1.970)	**(1.519)**
Effects															
R^2	0.171	0.550	0.550	0.549	0.550	0.109	0.441	0.402	0.432	0.402	0.097	0.555	0.552	0.555	0.552
ΔR^2	-	0.379	0.379	-0.001	0.001	-	0.332	0.293	-0.009	-0.039	-	0.458	0.455	0.000	0.000
f^2 (effect size)^2		0.842	0.842	-0.002	0.002		0.594	0.490	-0.016	-0.065		1.029	1.016	0.000	0.000
Sample size		112	112	112	112		116	116	116	116		121	121	121	121
Number of predictors		6	6	6	6		6	6	6	6		6	6	6	6
Pseudo F-test		88.433	88.433	-0.233	0.233		64.737	53.406	-1.727	-7.109**		117.330	115.781	0.000	0.000

Note 1: The paths non-significant at the 5% level are formatted in bold; $p<0.01$ ($t>2.58$); $p<0.05$ ($t>1.96$); $p<0.10$ ($t > 1.645$)

Note 2: The path in the reverse direction as hypothesized is marked with one asterisk

Note 3: To verify the significance of the added explanation by the change in the models, the effect size was examined. The effect size (f^2) is calculated as $\frac{R^2_{full\ model} - R^2_{partial\ model}}{1 - R^2_{full\ model}}$ (Chin et al. 2003). Then, a pseudo F-test for the significance of change in R^2 is calculated as $f^2 \times (n - k - 1)$ with 1 and (n-k) degrees of freedom, where n is the sample size and k is the number of predictors (Cohen 1988). The F-test critical value for this range of sample size is 3.94.

Note 4: The unexpected drop in the explanatory power in a MIMIC-based model is marked with two asterisks.

4.4.7.2 Mediation tests

At its core, the proposed model hypothesizes that the influence of perceived risk exposure on risk response intention is mediated though the overall risk response attitude construct (H3). To test this mediation effect, a PLS mediation analysis was initially performed, and a mediation effect for all three actions was found (action 1: partial mediation, action 2: full mediation, and action 3 full mediation). Nevertheless, the PLS mediation test using bootstrap results is based on Sobel's mediation test, which has been recently criticized for its susceptibility to various errors (Hayes 2015). Therefore, the approach recommended by Hayes (2015) was implemented and the direct and indirect effets of the independent variable on the dependent variable were separately examined. This was implemented using the "Process" macro in SPSS (www.processmacro.org). As this macro uses one variable per construct, the latent variable scores of perceived risk exposure, overall risk response attitude, and risk response intention were calculated with PLS and used. The results of this procedure are summarized in Table 4.16. The *p*-values of the direct effects suggest that they are not significant for any of the risk responses. The confidence intervals for the indirect effects for all the three acts suggest that the indirect effects are significant at 5% level (the macro does not provide a *p*-value for the indirect effects, and significance should be infered from the confidence intervals—significant at 5% level if 0 is not inside the interval). Therefore, these results support H3 for all three risk responses.

Table 4.16 Results of Mediation Tests

Risk Response	Path	Effect	SE	t-value	LLCI	ULCI	P	Significant at 5% Level
Act 1	Direct Effect	0.1419	0.0858	1.6547	-0.0281	0.3119	0.1009	Insignificant
	Indirect Effect *	0.3343	0.0741	-	0.2017	0.5035	-	Significant
Act2	Direct Effect	0.0607	0.0768	0.7901	-0.0915	0.2128	0.4311	Insignificant
	Indirect Effect *	0.1073	0.0584	-	0.0037	0.237	-	Significant
Act3	Direct Effect	0.0914	0.0765	1.1952	-0.0601	0.2429	0.2344	Insignificant
	Indirect Effect *	0.2872	0.0868		0.1251	0.4612	-	Significant

Note: * Bootstrap values

4.4.7.3 Comparison with the baseline model

In the final step of analysis, the variance explained in the risk response intention was compared between the proposed model and a baseline model built on Sitkin and Pablo (1992). This comparison used the *adjusted R^2* to penalize the proposed model for having more predictors (Theil 1961). The results (Table 4.17) indicate that for all three actions, more variance is explained by the proposed model. Therefore, this model improves the understanding of IT project managers' risk response decision making.

Table 4.17 The Relative Power of the Two Models to Explain Risk-response Intention

Model	Predictors	Act 1 R^2	Act 1 Sample Size	Act 1 Adjusted R^2	Act 2 R^2	Act 2 Sample Size	Act 2 Adjusted R^2	Act 3 R^2	Act 3 Sample Size	Act 3 Adjusted R^2
Proposed Model	3 Direct Effects (Overall Risk Response Attitude, Perceived Pressure, Perceived Control)	51.6%	112	50.3%	42.6%	116	41.1%	49.4%	121	48.1%
Baseline Model	2 Direct Effects (Perceived Risk Exposure, Risk Propensity)	24.8%	112	23.4%	3.4%	116	1.7%	18.9%	121	17.5%

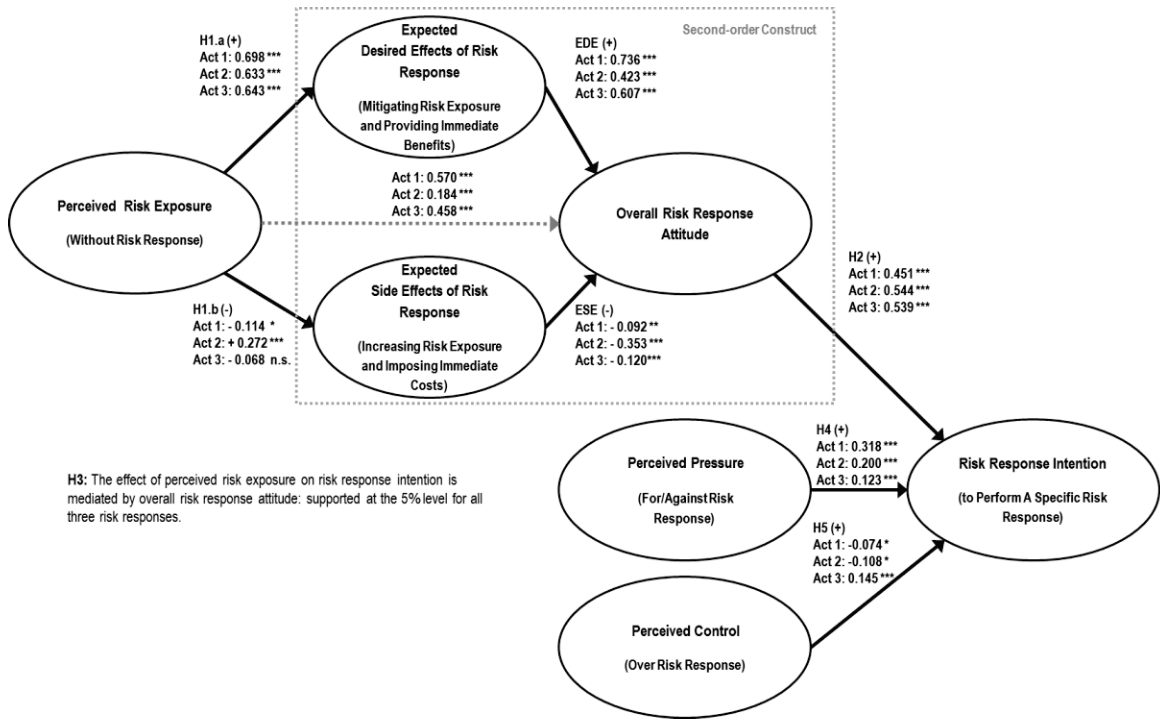
Note: Adjusted R-squared is computed as $R^2\text{adjusted} = 1 - \frac{(1-R^2)(N-1)}{N-p-1}$, with R^2= Original R-squared, P = Number of predictors, and N = Total sample size

Table 4.18 and Figure 4.4 summarize the main results.

Table 4.18 Summary of the Results

	Hypothesis	Act 1	Act 2	Act 3
H1	Perceived Risk Exposure → Overall Risk Response Attitude	Supported	Supported	Supported
H1.a	Perceived Risk Exposure → Expected Desired Effects	Supported	Supported	Supported
H1.b	Perceived Risk Exposure → Expected Side Effects	Partially Supported	Not Supported	Partially Supported
EDE	Expected Desired Effects → Overall Risk Response Attitude	Supported	Supported	Supported
ESE	Expected Desired Effects → Overall Risk Response Attitude	Supported	Supported	Supported
H2	Overall Risk Response Attitude → Risk Response Intention	Supported	Supported	Supported
H3	Perceived Risk Exposure → Risk Response Intention, Mediated by Overall Risk Response Attitude	Supported	Supported	Supported
H4	Perceived Pressure → Risk Response Intention	Supported	Supported	Supported
H5	Perceived Control → Risk Response Intention	Mixed Findings	Partially Supported	Supported

Belief Composites	All belief composites explain their corresponding construct	Supported	Supported	Supported
Explanatory Power of Model	The proposed model explains more variance in risk response intention than the baseline model	Supported	Supported	Supported



Note 1: The values are based on model M3b
Note 2: $p<0.01$ ($t>2.58$) ***; $p<0.05$ ($t>1.96$) **; $p<0.10$ ($t > 1.645$) *

Figure 4.4 Summary of the Results

4.4.7.4 Additional analysis

The analyses presented above focused on explaining risk response intention and the effect of perceived risk exposure. Nonetheless, TPB and its applications in IS consider additional interrelationships between the principal TPB constructs than the ones hypothesized in this paper. Therefore, due to the theory-building nature of this paper, and in order to further the understanding of potential interrelationships between the constructs, some additional analysis was performed. First, behavioral attitude, perceived pressure, and perceived control could be interrelated (Ajzen 1991). To examine this relationships, an extra analysis was performed. As depicted in Table 4.19, all paths were supported, except for perceived control → overall risk response attitude for act 3, which was partially supported (10% level). The addition of these paths to the structural model did not render the influence from perceived risk exposure on the overall risk response attitude insignificant; therefore, it suggests that perceived risk exposure is an important antecedent to attitude above and beyond perceived pressure and perceived control.

Table 4.19 Examining the Interrelationships of Principal Antecedents of Intention

Path	Act 1	Act 2	Act 3
Perceived Pressure → Overall Risk Response Attitude	0.460 (10.893)	0.208 (3.007)	0.396 (6.488)
Perceived Control → Overall Risk Response Attitude	0.119 (2.570)	0.390 (3.937)	0.108 (1.769)
Perceived Pressure → Perceived Control	0.451 (9.091)	0.342 (8.389)	0.438 (7.854)

Second, as Titah and Barki (2009) suggest, attitude and perceived pressure may have a non-linear, negative synergy relationship. That is, when attitude (either positive or negative) is weak, a strong perceived pressure might determine intention. Moreover, when the perceived pressure is weak, attitude might motivate intention. Therefore, the interaction effect between these two constructs was investigated. As Table 4.20 presents, the negative synergy of overall risk response attitude and perceived pressure was supported for Act 2 and was partially supported (at 10% level) for Act 1 and Act 3. While this does not influence the influence of overall risk response attitude on risk response intention, it renders the influence of perceived control for Act 1 and Act 2 and the influence of perceived pressure for Act 3 insignificant.

Table 4.20 Examining the Interaction of Attitude and Perceived Pressure

Coefficient / Model	Act 1		Act 2		Act 3	
	β	p-value	β	p-value	β	p-value
(Constant)	.076	.336	.067	.387	.053	.468
Overall Risk Response Attitude	.376	.000	.498	.000	.461	.000
Perceived Pressure	.331	.000	.214	.010	.132	.112
Perceived Control	-.001	.988	-.084	.317	.148	.047
Overall Risk Response Attitude × Perceived Pressure	-.117	.075	-.175	.020	-.100	.097

4.5 Discussion and Limitations

4.5.1 Discussion

Given the mixed results reported in the literature on the link between perceived risk exposure and risk response intention of IT project managers (Keil et al. 2000; Taylor 2005; Kutsch and Hall 2005), the proposed model focused on increasing the understanding of this link. Comparing the results of testing the three instances of the model revealed some repeating patterns.

First, the effect of perceived risk exposure on risk response decision was significantly mediated through overall risk response attitude (H3). This unpacks the path through which perceived risk exposure influences the risk response decision, providing some explanation for the mixed results reported in the literature: It suggests that even if the risk perception is high, a negative attitude towards a corresponding risk response might motivate the project manager to decide not to enact that response. Moreover, the overall risk response attitude significantly influenced risk response intention (H2). This construct was the strongest predictor of risk response intention. Together with the mediating role of perceived risk exposure, these findings are consistent with the findings of Kutsch et al. (2012) that "the major obstacle in increasing risk management reliability was less the issue of not detecting changes in the environment (risk) (e.g., Clarke 1993) but of actions taken to prevent risks from happening" (p. 7).

Second, both expected desired effects and expected side effects dimensions of overall risk response attitude were influential for all three risk responses (EDE/ESE). This finding suggests that while project managers see the benefits of risk responses, including their mitigation effects (e.g., Lyytinen et al. 1998), they are simultaneously concerned about the costs and side effects of enacting these managerial activities (Kutsch and Hall 2009). Moreover, a closer look at the belief composites underlying these two dimensions suggests that project managers consider the risk responses to mitigate more than one risk and to generate more than one side effect. This motivates further studies of the dynamic effects of enacting specific risk responses.

Third, while perceived risk exposure significantly influenced the expected desired effects across all three risk responses (H1.a), its effect on the expected side effects of enacting the risk responses (H1.b) was partial (at 10% level) for the first risk response, it was in the reverse direction for the second one and mixed for the third one. This suggests that IT project managers' evaluation of the expected desired effects of enacting a risk response is increased when there is some risk that the risk response can mitigate; however, the project managers separately evaluate the undesirability of the expected side effects of risk responses, and this evaluation is not biased by the level of the risks that enacting the risk response could mitigate. This finding has implications for the mediated effect of perceived risk exposure (H3): A further mediation test—using the two-mediator approach of Hayes (2015)—suggested that this mediated effect is chiefly through the path of *perceived risk exposure→expected desired effects→overall risk response attitude →risk response intention* rather than the path of *perceived risk exposure→expected side effects→overall risk response attitude →risk response intention*.

Fourth, the impact of perceived pressure was significant for all three risk responses (H4), suggesting that the risk response decision is not made in a void and that multiple sources of pressure directly (e.g., top management) or indirectly (e.g., training) influence IT project managers' risk response decisions. This result relates to that of Kutsch and Hall (2009) by providing more empirical evidence for their qualitative study and by extending their findings to specific risk responses rather than formal risk management practices.

Fifth, the findings on the influence of perceived control on risk response intentions were mixed (H5). While perceived control was a significant determinant of risk response intention for the third activity (i.e., dedicating much time to planning), only some support was found for its impact for the other two responses. In particular, the effect of perceived control was significant for the reflective-only version of the model for the second risk response and was insignificant for that of the first risk response. Moreover, this effect was significant at the 10% level for the MIMIC version of the model for the first two risk responses. These mixed findings marginalize the conclusions on the influence of this construct. One potential explanation for not identifying a strong effect from the perceived control construct is that Phase 1 selected risk responses that are within the span of control of IT project managers. This increases the mean of this construct and minimizes its variance, thus attenuating its impact on risk response intention. To explore the viability of this explanation, the mean/variance and kurtosis of the items of this construct were examined. Most project managers perceived that they had high control over these three risk responses. The perceived control items have the highest mean (6.2), lowest variance (1.0), and the highest kurtosis values (4.640, 3.473, and 5.137 for the three perceived control items) among the determinants of intention. Moreover, a potential explanation for the difference between the reflective-only and MIMIC versions of the models concerns the use of the factor scores of the MIMIC constructs for validating the MIMIC-based version of the models. Research suggests that such factor score regression (DiStefano et al. 2009), similar to other types of combination of items, such as item parceling (Hall et al. 1999), can lead to significant changes in the properties of a model. This is specifically the case for using PLS to compute factor scores, as "[t]he composite variable model used by PLS cannot provide error free construct scores because indicator variance is not partialled, but all variance is included in the construct scores" (Rönkkö and Ylitalo 2011). It is noteworthy that this rationale also provides some explanation for the drop in the added explanation of risk response intention between the reflective-only models (Model 3a, activity 2) and the MIMIC models (Model 3b, activity 2).

Finally, the results indicated a low variance explained by the perceived risk exposure composite. One potential explanation for this low amount is that the present conceptualization of perceived risk exposure considers an equal importance for the probability and magnitude dimensions of this construct. This is consistent with the simple multiplicative nature of creating composite items in TPB. However, it is suggested that the magnitude of loss if undesired outcomes happen plays a more important role than the probability of undesired outcomes in constituting the perceived risk exposure of IT project managers (Keil et al. 2000a). A further analysis of the data suggested that if the values of probability and magnitude of loss are used as two separate dimensions for the perceived risk exposure construct, the variance explained will increase significantly.

4.5.2 Limitations

This study has some limitations. First, it focuses only on three specific risk responses. As a consequence, the empirical results are skewed toward the risk responses that met the selection criteria of Phase 1 (especially, being within the locus of control and not being practiced frequently). Minding this limitation, although the proposed model is expected to hold for any other risk response, the conclusions based on the obtained empirical results have been made with the caution not to generalize them to other risk responses. In the present study, the number of studied risk responses could not have been increased because of the data collection limitations, which leaves the investigation of the other important risk responses for future research. Another limitation of this study is examining risk response intentions but not the actual risk response enactment. Although intention is highly correlated with actual behavior (Sheppard et al. 1988), this opens another avenue for future research. Finally, this paper assumes risk response to be an individual-level decision of IT project managers and includes the perceived pressure construct that takes into account the influence of other important people on this behavior. Nevertheless, considering the role of the other stakeholders (Lim et al. 2011), studying this decision as a group-level phenomenon would be very promising.

4.6 Conclusions

The objective of this paper was to revisit the effect of perceived risk exposure on the risk response intentions of IT project managers. By reviewing the behavioral IT project risk management literature and by leveraging TPB (Ajzen 1991; Fishbein and Ajzen 2010) as an integrative framework, a research model was developed. The central hypothesis of this model was that the influence of perceived risk exposure on risk response intentions is mediated through overall risk response attitude. Overall risk response attitude was conceptualized to comprise expected desired (e.g., risk mitigation) effects and expected side effects of enacting a specific risk response. Moreover, perceived risk exposure was defined to reflect the set of undesired outcomes that could be mitigated if the specific risk response were enacted. Normative and control constructs relevant to performing the specific risk response were also included in the model.

The model was further specified and instantiated for three important, controllable, but not widely practiced risk responses (Phase 1). These risk responses are: having user representatives as project team members, appreciating team members' work in a tangible way during the project, and dedicating much effort to planning. Then, the three specified models were enriched by creating the belief composites that underlie the key determinants of risk response intention (i.e., expected desired effects, expected side effects, perceived pressure, and perceived control) (Phase 2). Next, the three specified and enriched models were empirically validated using a survey (Phase 3).

This study makes important theoretical and methodological contributions. The main theoretical contributions are to IT project risk management research. First, this paper offers an explanation for IT project managers' intention to perform specific risk responses by synthesizing various determinants discussed in the literature. By suggesting a mediated effect from perceived risk exposure to risk response intention, and by including additional determinants of this intention, light is shed on the mixed results between risk perception and risk response reported in the literature (Keil et al. 2000a; Taylor 2005). Moreover, by conceptualizing risk-response attitude as a second-order construct, this paper emphasizes how the expected side effects of enacting specific risk responses, besides their desired (e.g., risk mitigation) effects, influence risk response intentions. Future research can take the same approach to examine other important risk responses that were not studied here.

This paper also contributes to IT project risk management research by unpacking the principal determinants of risk response intention (i.e., expected desired effects, expected side effects, perceived pressure, and perceived control) into fine-grained beliefs and weights; therefore, it enriches the understanding of the motivations behind enacting certain specific risk responses or the lack thereof. The granular beliefs identified in this study can be used to develop risk management practices that better suit project managers' needs, for example, those that would have fewer side effects.

The primary methodological contribution of the paper is back to the reasoned action research. More precisely, there are some concerns about whether to measure the TPB determinants using reflective items or belief composites (see Fishbein and Ajzen 2010, p.104). This paper introduces the MIMIC approach (Diamantopoulos and Winklhofer 2001) as a way of simultaneously specifying these determinants as reflective constructs and as belief composites.

This paper has some implications for IT project risk management practice. First, its findings support the observation of de Bakker et al. (2010, p.500) that "Literature (e.g., Kutsch and Hall, 2005) indicates that knowledge of risks does not automatically imply that this knowledge is used for managing those risks." It does so by suggesting that the effect of perceived risk exposure mediated through overall risk response attitude, also that perceived pressure and perceived control have some influence on risk management decisions. Therefore, and taking into account that risk response planning is often skipped (Taylor 2005), the findings of this study motivate shifting some attention from risk assessment to risk-response planning and enactment.

The second practical implication is for project management training and governance. The paper builds on the idea that understanding the antecedents of a behavior is the key to changing that behavior (Fishbein and Ajzen 2010). Therefore, if one has the objective of promoting a certain risk response, such as increasing user participation, it should be performed through influencing project managers' granular beliefs or the weights of these beliefs. To do so, the mitigation effects of risk responses should be emphasized, and the project managers should be invited to accept some of the side effects of the responses. Moreover, as previous studies have noted, lack of top management support (Kutsch and Hall 2009) and lack of a supportive organizational risk management infrastructure and culture (Carr 1997) are important reasons for not enacting the risk responses; therefore, these issues should be addressed before a wider practice of specific risk responses are expected. Also, the resources required for enacting responses should be provided to IT project managers, and the managers should be made aware of the existence of such support.

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Appendix A: A Compilation of Heuristics

In order to compile the representative list of heuristics, a review of the articles was conducted. Online databases were used to search for keywords such as risk, mitigation, strategies, and remedies, in the past 25 years of the AIS Basket of 8 journals. Forward and backward searches were also performed when necessary (Webster and Watson 2002). This resulted in identifying nine articles that included a list of such heuristics (i.e., Addison and Vallabh 2002; Baccarini et al. 2004; Barki et al. 2001; Boehm 1991; Keil et al. 1998; Lyytinen et al. 1998; Nelson 2007; Sumner 2000; Tesch et al. 2007). Then, following Nelson (2007), a matrix that maps specific risk responses over specific risks was created. In this matrix, the higher level categories of risk responses were included as row labels. These categories are: internal integration, external integration, and formal planning (Barki et al. 2001; McFarlan 1981). Likewise, the higher level categories of risk sources were included as the following column labels: user risks, team risks, requirements risks, planning and control risks, and technology and complexity risks (Wallace et al. 2004). Next, to populate the matrix, a reduced list of risk responses was adapted from Barki et al. (2001), and then the other risk responses mentioned in the identified articles were merged or added as appropriate. Finally, the risks that were added by these risk responses were synthesized. To be parsimonious, the risk responses that were mentioned by two or more articles were kept.

Appendix B: The Instruments

Phase 1: Questionnaire

We are interested in three aspects of IT project management activities. These aspects are:
1: IMPORTANCE FOR MANAGING RISK: How important is doing the activity for responding to the risks in IT projects?
2: EXTENT OF PM's CONTROL: To what extent doing the activity is under the control of a typical IT project manager?
3: FREQUENCY PRACTICED: How common is doing the activity in the IT projects you have seen so far?
Please think of IT development/implementation projects you have seen in the past. Then, rate each of the IT project management activities listed below along the three mentioned aspects.

Project Management Activity	1: IMPORTANCE FOR MANAGING RISKS?	2: EXTENT OF PM's CONTROL?	3: FREQUENCY PRACTICED?
- Making users responsible to do a part of the project.	L - M - H	L - M - H	L - M - H
- Having end-user representatives as project team members.	L - M - H	L - M - H	L - M - H
- Getting users' formal approval on the work done.	L - M - H	L - M - H	L - M - H
- Having a project champion.	L - M - H	L - M - H	L - M - H
- Staffing project team with appropriate expertise.	L - M - H	L - M - H	L - M - H
- Putting every effort to reduce team member turnover.	L - M - H	L - M - H	L - M - H
- Appreciating team members' work in a tangible way during the project.	L - M - H	L - M - H	L - M - H
- Putting every effort to coordinate project team members' work.	L - M - H	L - M - H	L - M - H
- Keeping project members informed about major decisions.	L - M - H	L - M - H	L - M - H
- Drawing up a formal agreement of work to be done.	L - M - H	L - M - H	L - M - H
- Scope freeze (no longer accepting changes in the features and functionalities).	L - M - H	L - M - H	L - M - H
- Incremental development.	L - M - H	L - M - H	L - M - H
- Prototyping.	L - M - H	L - M - H	L - M - H
- Comprehensive testing before going live.	L - M - H	L - M - H	L - M - H
- Pilot testing.	L - M - H	L - M - H	L - M - H
- Using tools such as PERT or CPM to closely follow the project's status.	L - M - H	L - M - H	L - M - H
- Paying special attention to project planning.	L - M - H	L - M - H	L - M - H
- Allocating significant resources to estimate project times and budgets.	L - M - H	L - M - H	L - M - H
- Following an appropriate project management methodology.	L - M - H	L - M - H	L - M - H
- Getting top management support of the project.	L - M - H	L - M - H	L - M - H

How many years of experience do you have in the field of IT?

❍ Less than 1 year	❍ 11 to 15 years	❍ 26 years or more
❍ 1 to 5 years	❍ 16 to 20 years	
❍ 6 to 10 years	❍ 21 to 25 years	

How do you evaluate your knowledge about IT project management?

Low Medium High

What is your current occupation? (select as many as applicable)

IT Project Manager Academic – Professor Academic - Student

Phase 2: Interview Guide

Principal Open-Ended Questions in the Belief-Elicitation Study

<table>
<tr><th colspan="2">Instructions</th></tr>
<tr><td colspan="2">One of the following actions was read and explained for the informant. Then, the following questions were asked to extract the accessible beliefs.
1- Having one or more user representatives in the project team from the very beginning.
2- Showing appreciation to project team members in a tangible way during the project.
3- Dedicating much effort to project planning.</td></tr>
<tr><th>Belief Category</th><th>Question</th></tr>
<tr><td>Attitudinal Beliefs (Risk-mitigating and Risk-increasing Effects)</td><td>1. Please consider doing [the indicated activity].
a. What do you think as the advantages of doing [the indicated activity]?
b. What do you think as the disadvantages of doing [the indicated activity]?
c. What else comes to mind when you think about doing [the indicated activity]?</td></tr>
<tr><td>Perceived Pressure Beliefs</td><td>2. Please consider important others in your organization whose opinion about [the indicated activity] is important to you.
a. Please list the individuals or groups who would approve or think you should undertake [the indicated activity]?
b. Please list the individuals or groups who would disapprove or think you should not undertake [the indicated activity]?
3. Please consider your role-models when it comes to undertake such activities.
a. Sometimes, when we are not sure what to do, we look to see what others are doing. Please list the individuals who, in a similar project situation will undertake [the indicated activity].
b. Sometimes, when we are not sure what to do, we look to see what others are doing. Please list the individuals or groups who, in a similar project situation will not undertake [the indicated activity].</td></tr>
<tr><td>Perceived Control Beliefs</td><td>4. Please consider your ability to undertake [the indicated activity].
a. Please list any factors or circumstances that would make it easy or enable you to undertake [the indicated activity].
b. Please list any factors or circumstances that would make it difficult or prevent you to undertake [the indicated activity].</td></tr>
</table>

Phase 3: Questionnaire

Demographics and Screening Items

Please tell us about your background using the following items.

How many years of IT project management experience do you have?

- Less than 1 year
- 1 to 5 years
- 6 to 10 years
- 11 to 15 years
- 16 to 20 years
- 21 to 25 years
- 26 years or more

Are you currently the project manager for an IT project? (Yes/No) **[Screen out if no]**

What is your current role within your organization? (select as many as applicable)

- ❑ Project Manager
- ❑ Chief Information Officer (CIO) or Chief Technology Officer (CTO)
- ❑ Business Analyst
- ❑ Programmer
- ❑ Secretary **[screen out if this is selected]**
- ❑ Program Manager
- ❑ Project Control Officer (PCO)

Which of the following items includes the names of two well-known software/IT development approaches?

- ❍ McKinsey and Deloitte
- ❍ PMBoK and PMI
- ❍ Agile and waterfall **[screen out if this is not selected]**
- ❍ HBR and ACM
- ❍ Sarbane and Oxley

Which of the following items is false?

- ❍ WBS is a decomposition of project into smaller components.
- ❍ PMI is a professional association.
- ❍ SAP is a project risk management software. **[screen out if this is not selected]**
- ❍ PERT is a planning tool.

Let's talk about one particular project that you are currently managing. If you are managing more than one project, please focus on the one that started most recently. From now on, we will call it "THIS PROJECT." Several parts of this survey ask questions about THIS PROJECT. Please describe THIS PROJECT using the following items.

How many people (including yourself) are in the core team of THIS PROJECT?

- ❍ 4 people or fewer **[screen out if selected]**
- ❍ 5 to 19 people
- ❍ 20 to 49 people
- ❍ 50 to 99 people
- ❍ 100 people or more

What is the approximate budget of THIS PROJECT?

- Less than $100,000
- $100,000 to $500,000
- $500,000 to $1,000,000
- $1,000,000 to $5,000,0000
- $5,000,000 to $10,000,000
- $10,000,000 to $ 50,000,000
- $50,000,000 or more

THIS PROJECT is mostly about...

- technical infrastructure (infrastructure software/hardware, for example, operating systems, networks, and servers)
- business application (business software/process, for example, ERP, CRM, productivity applications)
- both business application and technical infrastructure

Which of the following items best describes the nature of THIS PROJECT?

- Advising about IT-related matters.
- Supporting and maintaining a system that is already implemented.
- Developing and implementing a new system.
- Configuring and implementing a purchased package.
- Rolling-out an existing system to other parts of the organization.

How many end-users (including the organization's clients or customers) will directly interact with the system delivered by THIS PROJECT?

- No end-users will directly interact with the system
- 1 to 50
- 50 to 200
- 200 to 500
- 500 to 1,000
- 1,000 to 10,000
- 10,000 to 100,000
- 100,000 to 1,000,000
- 1,000,000 to 10,000,000
- 10,000,000 or more

The software development approach adopted for THIS PROJECT is...

- Waterfall (or its variants)
- Agile (or its variants)
- The organization's proprietary methodology
- No specific methodology
- Other __

What is the estimated duration of THIS PROJECT?

- 3 months or less
- 3 to 6 months
- 6 to 12 months
- 12 to 18 months
- 18 to 24 months
- 24 to 36 months
- 36 months or more
-

What percentage of THIS PROJECT has currently been completed? (___ % of time progress)

Are you a certified project manager? (Yes/No)

What certification(s) do you have? Please specify.

- PMP
- PMI-ACP
- ITIL V3
- PRINCE2
- Other __

How many IT projects have you managed (in whole or in part) in your career?

- ❍ 10 projects or fewer
- ❍ 11 to 20 projects
- ❍ 21 to 50 projects
- ❍ 51 to 80 projects
- ❍ 81 projects or more

What is the highest educational degree that you have obtained?
❍ Community College / CEGEP
❍ Undergraduate
❍ Post-graduate: Certificate/Diploma
❍ Post-graduate: Master's Degree/ MBA
❍ Post-graduate: Ph.D.

In which industry THIS PROJECT is being implemented?

- Agriculture / Forestry
- Banking, Finance , Insurance
- Business / Personal Services, Real Estate
- Construction / Mining
- Education / Museums / Zoos
- Engineering & Management
- Government (federal, state, local)
- Health
- Hotel / Recreational / Amusement
- Legal
- Manufacturing
- Retail, Wholesale / Distribution
- Social Services, Public Administration
- Transport
- Other (Please specify) __
- Telecommunications / ICT

How old are you?

- 25 years or less
- 26-30 years
- 31 to 40 years
- 41 to 50 years
- 51 years or more

Your gender is: (Male/Female)

Reflective Items

[Intention]

	Activity 1	Activity 2	Activity 3	Anchors
RI_1	I intend to have user representatives in THIS PROJECT.	I intend to show tangible appreciation during THIS PROJECT.	I intend to dedicate much effort to planning in THIS PROJECT.	Definitely Do Not: Definitely Do)
RI_2	I will have user representatives in THIS PROJECT.	I will show tangible appreciation during THIS PROJECT.	I will dedicate much effort to planning in THIS PROJECT.	Very Unlikely: Very Likely
RI_3*	I am willing to have user representatives in THIS PROJECT.	I am willing to show tangible appreciation during THIS PROJECT.	I am willing to dedicate much effort to planning in THIS PROJECT.	Definitely True: Definitely False
RI_4	I plan to have user representatives in THIS PROJECT.	I plan to show tangible appreciation during THIS PROJECT.	I plan to dedicate much effort to planning in THIS PROJECT.	Strongly Disagree: Strongly Agree

[Perceived Risk Exposure]

Activity 1	If THIS PROJECT is continued without having user representatives,
Activity 2	If THIS PROJECT is continued without showing tangible appreciation to project team members during the project,
Activity 3	If THIS PROJECT is continued without dedicating much effort to planning,
RPRE_1	many things can go wrong.
RPRE_2	significant undesired events will likely happen.
RPRE_3	severe negative organizational consequences would be possible.
RPRE_4	the project would become very risky.
RPRE_5	some significant undesired events would be very likely.
All Anchors: (Strongly Disagree: Strongly Agree)	

[Attitude towards risk response]

Activity 1	Overall, having user representatives in THIS PROJECT would be...
Activity 2	Overall, showing tangible appreciation during THIS PROJECT would be...
Activity 3	Overall, dedicating much effort to planning in THIS PROJECT would be...
ROA_1	Harmful: Beneficial
ROA_2	Foolish: Wise
ROA_3	Rational: Irrational
ROA_4	Unadvisable: Advisable

[Risk-mitigation Effects Attitude]

Activity 1	Overall, having user representatives is...
Activity 2	Overall, showing tangible appreciation during THIS PROJECT is...
Activity 3	Overall, dedicating much effort to planning is...
RAM_1	essential for mitigating some significant risks in THIS PROJECT.
RAM_2	important for reducing the risk exposure of THIS PROJECT.
RAM_3	vital for risk mitigation in THIS PROJECT.
RAM_4	useful for preventing significant undesired events in THIS PROJECT.

[Risk-increasing Effects Attitude]

Activity 1	Overall, having user representatives will...
Activity 2	Overall, showing tangible appreciation during THIS PROJECT will...
Activity 3	Overall, dedicating much effort to planning will...
RAS_1	create a lot of side effects in THIS PROJECT.
RAS_2	impose significant costs on THIS PROJECT.
RAS_X	if you are still reading this, please select 7 for THIS ITEM. [TERMINATE]
RAS_3	introduce new risks to THIS PROJECT.
RAS_4	increase the risk exposure of THIS PROJECT.

[Perceived Pressure]

In the context of THIS PROJECT, overall...

#	Activity 1	Activity 2	Activity 3
RPP_1	I am under (strong pressure against: strong pressure for) having user representatives as project team members.	I am under (strong pressure against : strong pressure for) showing tangible appreciation during the project	I am under (strong pressure against : strong pressure for) dedicating much effort to planning
RPP_2	most people and entities who are important to me (strongly discourage: strongly encourage) having user representatives as project team members.	most people and entities who are important to me (strongly discourage : strongly encourage) showing tangible appreciation during the project.	most people and entities who are important to me (strongly discourage: strongly encourage) dedicating much effort to planning.
RPP_3	I am (strongly advised to avoid having: strongly advised to have) user representatives as project team members.	I am (strongly advised to avoid showing: strongly advised to show) tangible appreciation during the project.	I am (strongly advised to avoid dedicating: strongly advised to dedicate) much effort to planning.
RPP_4	People or entities that influence my way of managing projects (strongly expect NOT to: strongly expect to) have user representatives as project team members	People or entities that influence my way of managing projects... (strongly expect NOT showing :strongly expect showing) tangible appreciation during the project.	People or entities that influence my way of managing projects (strongly expect NOT dedicating: strongly expect dedicating) much effort to planning.

[Perceived Control]

In the context of THIS PROJECT ... (Strongly Disagree: Strongly Agree)

#	Activity 1	Activity 2	Activity 3
RPC_1	if I really wanted to, I could have user representatives.	if I really wanted to, I could show tangible appreciation during the project.	if I really wanted to, I could dedicate much effort to planning.
RPC_2	I am confident that I am able to have user representatives, if I really wanted to.	I am confident that I am able to show tangible appreciation during the project, if I really wanted to.	I am confident that I am able to dedicate much effort to planning, if I really wanted to.
RPC_3	I have the ability to have user representatives as project team members, if I really wanted to.	I have the ability to show tangible appreciation during the project, if I really wanted to.	I have the ability to dedicate much effort to planning, if I really wanted to.
RPC_4	everything that would be required for having user representatives is available.	everything that would be required for showing tangible appreciation during the project is available.	everything that would be required for dedicating much effort to planning is available.

[Risk Propensity]

RiskPro_1	How would you rate your own willingness to take risks when managing IT projects compared to other individuals?	(Much Less Willing : Much More Willing)
RiskPro_2	I believe that I am a risk-taker when managing IT projects.	(Strongly Disagree: Strongly Agree)

RiskPro_3	To me, IT project managers' taking risks when managing IT projects is	(Very Bad: Very Good)

[Applying Formal Risk Management]

A$_RFRM - I am applying formal risk management practices in THIS PROJECT. (Strongly Disagree: Strongly Agree)

[Marker Variable]

How true is each of the following statements about the way you make decisions and solve problems when managing IT projects?

- When I have much experience or knowledge about a problem, I almost always trust my intuitions.
- I often make decisions based on my gut feelings.
- I would rather think in terms of theories than facts.
- When working on a problem, I prefer to work slowly so that there is time for all the pieces to come together.
- If I have to, I can usually give reasons for my intuitions.
- If you are still reading this please select Definitely True. [TERMINATE]
- I tend to use my heart as a guide for my actions.
- I enjoy thinking in abstract terms.
- After working on a problem for a long time, I like to set it aside for a while before making a final decision.

Composite Items

[Perceived Risk Exposure – Composite]

How likely is each of the following to occur in THIS PROJECT?	How harmful would each of the following be if it occurs in THIS PROJECT?	Activity 1 - (P x L)
PRE_P_1	PRE_L_1	End-user resistance
PRE_P_2	PRE_L_2	Delivering a system with the wrong functionalities
PRE_P_3	PRE_L_3	Producing a not-user-friendly system interface
PRE_P_4	PRE_L_4	Project team wasting time deciding about system functionalities
PRE_P_5	PRE_L_5	Failure in communicating with the end-users' community
PRE_P_6	PRE_L_6	Forgetting to address some user requirements

How likely is each of the following to occur in THIS PROJECT?	How harmful would each of the following be if it occurs in THIS PROJECT?	Activity 2 - (P x L)
PRE_P_1	PRE_L_1	low team member motivation to continue the work
PRE_P_2	PRE_L_2	low team spirit
PRE_P_3	PRE_L_3	weak relationships among the project team members

PRE_P_4	PRE_L_4	project team member turnover
PRE_P_5	PRE_L_5	low project team member job satisfaction

How likely is each of the following to occur in THIS PROJECT?	**How harmful would each of the following be if it occurs in THIS PROJECT?**	**Activity 3 - (P x L)**
PRE_P_1	PRE_L_1	lacking an estimation of the project schedule and budget
PRE_P_2	PRE_L_2	low understanding of the project
PRE_P_3	PRE_L_3	not including risk mitigation activities in the project
PRE_P_4	PRE_L_4	lacking a precise work baseline
PRE_P_5	PRE_L_5	being unaware of critical dependencies (e.g., within the project or with other projects)
PRE_P_6	PRE_L_6	deviating from project schedule
PRE_P_7	PRE_L_7	not delivering what was expected

[Risk-mitigation Effects Attitude – Composite]

Activity 1 - (B x E)			
To what extent would having user representatives...		**In THIS PROJECT, how worthy is putting managerial efforts into each of the following items?**	
AM_B_1	prevent end-user resistance?	AM_E_1	preventing end-user resistance
AM_B_2	prevent delivering a system with the wrong functionalities?	AM_E_2	preventing delivering a system with the wrong functionalities
AM_B_3	prevent producing a not-user-friendly system interface?	AM_E_3	preventing producing a not-user-friendly system interface
AM_B_4	prevent project team wasting time deciding about system functionalities?	AM_E_4	preventing project team wasting time deciding about system functionalities
AM_B_5	prevent failure in communicating with the end-users' community?	AM_E_5	preventing failure in communicating with the end-users' community
AM_B_6	prevent forgetting to address some user requirements?	AM_E_6	preventing forgetting to address some user requirements

Activity 2 - (B x E)			
In THIS PROJECT, to what extent would showing tangible appreciation to project team members during the project...		**In THIS PROJECT, how worthy is putting managerial efforts into each of the following items?**	
AM_B_1	increase team member motivation to continue the work?	AM_E_1	increasing team member motivation to continue the work
AM_B_2	promote team spirit?	AM_E_2	improving team spirit
AM_B_3	improve relationships among the project team members?	AM_E_3	strengthening relationships among the project team members
AM_B_4	prevent project team member turnover?	AM_E_4	preventing project team member turnover
AM_B_5	increase project team member job satisfaction?	AM_E_5	increasing project team member job satisfaction

Activity 3- (B x E)			
In THIS PROJECT, to what extent would dedicating much effort to planning...		**In THIS PROJECT, how worthy is putting managerial efforts on each of the following items?**	
AM_B_1	provide an estimation of the project schedule and budget?	AM_E_1	providing an estimation of the project schedule and budget
AM_B_2	improve the team's understanding of the project?	AM_E_2	improving understanding of the project
AM_B_3	enable including risk mitigation activities in the project?	AM_E_3	including risk mitigation activities in the project
AM_B_4	lead to having a precise work baseline?	AM_E_4	having a precise work baseline
AM_B_5	lead to identifying critical dependencies (e.g., within the project or with other projects)?	AM_E_5	identifying critical dependencies (e.g., within the project or with other projects)
AM_B_6	prevent deviating from project schedule?	AM_E_6	preventing deviation from project schedule
AM_B_7	prevent not delivering what was expected?	AM_E_6	delivering what was expected

[Risk-increasing Effects Attitude – Composite]

Activity 1 - (B x E)			
To what extent would having user representatives...		**How harmful would each of the following be if it occurs in THIS PROJECT?**	
AS_B_1	create conflict between team and end users?	AS_E_1	Conflict between team and end users
AS_B_2	enable end-users to introduce personal agendas into system requirements?	AS_E_2	End-users introducing personal agendas into system requirements
AS_B_3	permit end-users to waste project time on attempts at perfecting system functionalities?	AS_E_3	End-users wasting project time on attempts to perfect system functionalities
AS_B_4	lead to leaking of project's inside information to end-users?	AS_E_4	Leaking of project's inside information to end-users
AS_B_5	lead to having a team with unnecessary people onboard?	AS_E_5	Having a team with unnecessary people onboard

Activity 2 - (B x E)			
In THIS PROJECT, to what extent would showing tangible appreciation to project team members during the project...		**How harmful would each of the following be if it occurs in THIS PROJECT?**	
AS_B_1	lead to team members feeling they are not being treated fairly?	AS_E_1	team members feeling they are not being treated fairly
AS_B_2	lead to wasting project time?	AS_E_2	wasting project time
AS_B_3	create conflicts within the project team?	AS_E_3	conflicts within the project team
AS_B_4	lead to team members' being overconfident about the ultimate success of the project (thus working less hard and not being fully dedicated)?	AS_E_4	team members' being overconfident about the ultimate success of the project (thus working less hard and not being fully dedicated)

Activity 3 - (B x E)			
In THIS PROJECT, to what extent would dedicating much effort to planning...		**How harmful would each of the following be if it occurs in THIS PROJECT?**	
AS_B_1	lead to producing a detailed work plan likely to change later?	AS_E_1	producing a detailed work plan that would be likely to change later
AS_B_2	result in wasting time discussing the plan with many people?	AS_E_2	wasting time discussing the plan with many people
AS_B_3	lead to doing an activity that is perceived – especially by clients— as not valuable?	AS_E_3	doing an activity that is perceived —especially by clients— as not valuable
AS_B_4	lead to limiting innovation and flexibility by committing to too many details upfront?	AS_E_4	limiting innovation and flexibility by committing to too many details upfront
AS_B_5	lead to keeping the project team from doing the actual project work?	AS_E_5	keeping the project team from doing the actual project work
AS_B_6	lead to being unable to deliver soon, especially when there is pressure for it?	AS_E_6	being unable to deliver soon, especially when there is pressure for it

[Perceived Pressure – Composite]

(B x M)	**In the context of THIS PROJECT, to what extent do you think each of the following individuals/entities is opposed to or in favor of …?**	**In THIS PROJECT, when it comes to deciding whether or not to …, to what extent should you comply with the expectations of the following people/entities?**
Activity 1	If THIS PROJECT is continued without having user representatives,	
Activity 2	If THIS PROJECT is continued without showing tangible appreciation to project team members during the project,	
Activity 3	If THIS PROJECT is continued without dedicating much effort to planning,	
your upper management	PP_B_1	PP_M_1
your organization's way of doing things (e.g., project management methodology)	PP_B_3	PP_M_2
your project team members	PP_B_3	PP_M_3
your client/sponsor	PP_B_4	PP_M_4
your peer project managers	PP_B_5	PP_M_5
the ideal project manager depicted in your past training	PP_B_6	PP_M_6
the professional associations you are affiliated with	PP_B_7	PP_M_7

[Perceived Control – Composite]

In THIS PROJECT, I will have each of the following items.	If you wanted to have user representatives as team members in THIS PROJECT, to what extent would each of the following be essential to have?	**Activity 1 - (B x P)**
PC_B_1	PC_P_1	the authority to choose the right user representatives.
PC_B_2	PC_P_2	user representatives who are personally willing to participate.
PC_B_3	PC_P_3	someone on the project team who can interact with the user representatives.
PC_B_Check	-	if you are still paying attention, please select N/A.
PC_B_4	PC_P_4	user representatives with some knowledge of IT (its capabilities and limitations) and projects.
PC_B_5	PC_P_5	upper management's explicit support for having user representatives
PC_B_6	PC_P_6	a budget for having user representatives
PC_B_7	PC_P_7	an organizational political environment that favors having user representatives

In THIS PROJECT, I will have each of the following items.	If you wanted to show tangible appreciation during THIS PROJECT, to what extent would each of the following be essential to have?	**Activity 2 - (B x P)**
PC_B_1	PC_P_1	an adequate budget for showing tangible appreciation during the project.
PC_B_2	PC_P_2	some time slack in the schedule to show tangible appreciation during the project.
PC_B_3	PC_P_3	the authority to show tangible appreciation during the project.
PC_B_X	-	if you are still paying attention, please select N/A.
PC_B_4	PC_P_4	upper management's explicit support for showing tangible appreciation during the project.
PC_B_5	PC_P_5	an organizational culture that favors tangible appreciation (e.g., social gatherings).

In THIS PROJECT, I will have each of the following items.	If you wanted to dedicate much effort to planning THIS PROJECT, to what extent would each of the following be essential to have?	**Activity 3 - (B x P)**
PC_B_1	PC_P_1	the ability to foresee the details required for planning ahead.
PC_B_2	PC_P_2	a proper project scope definition.
PC_B_3	PC_P_3	access to people —who will be involved in the project—to get their input.
PC_B_X	-	if you are still paying attention, please select N/A.
PC_B_4	PC_P_4	access to people required to answer questions about project (e.g., technical people, client)
PC_B_5	PC_P_5	access to easy-to-use tools for planning.
PC_B_6	PC_P_6	upper management's explicit support of dedicating much effort to planning
PC_B_7	PC_P_7	some time slack to spend on project planning.

Appendix C: Survey Statistics

Risk Response 1

Construct Cross-correlations with √(AVE) on the Diagonal

		AS	INT		PC	PP	PRE
AM	0.890						
AS	-0.255	0.880					
INT	0.694	-0.204	0.929				
OA	0.758	-0.272	0.670	0.910			
PC	0.402	-0.175	0.372	0.425	0.752		
PP	0.614	-0.254	0.636	0.662	0.462	0.877	
PRE	0.710	-0.120	0.484	0.577	0.288	0.432	0.872

Item Weights

		AS	INT		PC	PP	PRE
RAM_1	0.911	-0.343	0.577	0.669	0.320	0.519	0.664
RAM_3	0.892	-0.125	0.665	0.679	0.363	0.618	0.666
RAM_4	0.867	-0.213	0.611	0.676	0.394	0.498	0.560
RAS_2	-0.199	0.823	-0.128	-0.196	-0.098	-0.188	-0.184
RAS_3	-0.219	0.880	-0.189	-0.234	-0.161	-0.257	-0.039
RAS_4	-0.252	0.934	-0.217	-0.283	-0.197	-0.230	-0.091
RI_1	0.649	-0.125	0.911	0.636	0.359	0.535	0.498
RI_2	0.655	-0.195	0.948	0.609	0.344	0.590	0.447
RI_4	0.630	-0.245	0.927	0.623	0.335	0.645	0.404
ROA_1	0.704	-0.258	0.637	0.922	0.366	0.615	0.529
ROA_2	0.658	-0.257	0.503	0.895	0.348	0.470	0.521
ROA_4	0.702	-0.230	0.676	0.912	0.441	0.704	0.526
RPC_1	0.278	-0.303	0.113	0.286	0.629	0.290	0.123
RPC_2	0.308	-0.288	0.195	0.266	0.719	0.262	0.162
RPC_3	0.340	-0.022	0.399	0.391	0.886	0.444	0.294
RPP_2	0.496	-0.271	0.525	0.566	0.366	0.877	0.339
RPP_3	0.486	-0.199	0.478	0.548	0.354	0.826	0.348
RPP_4	0.618	-0.205	0.650	0.624	0.480	0.925	0.439
RPRE_2	0.704	-0.079	0.518	0.608	0.265	0.428	0.897
RPRE_4	0.581	-0.084	0.402	0.452	0.228	0.389	0.863
RPRE_5	0.557	-0.157	0.326	0.431	0.260	0.303	0.855

Construct Validity and Reliability Statistics

	AVE	Composite Reliability	Cronbach's Alpha
AM	0.792	0.920	0.869
AS	0.775	0.912	0.854
INT	0.862	0.950	0.920
OA	0.827	0.935	0.896
PC	0.566	0.793	0.692
PP	0.769	0.909	0.850
PRE	0.760	0.905	0.843

Risk Response 2

Construct Cross-correlations with √(AVE) on the Diagonal

	AM	AS	INT	OA	PC	PP	PRE
AM	0.898						
AS	0.304	0.928					
INT	0.180	-0.289	0.833				
OA	0.294	-0.241	0.611	0.818			
PC	-0.101	-0.321	0.185	0.401	0.874		
PP	0.330	0.018	0.412	0.381	0.380	0.855	
PRE	0.653	0.273	0.172	0.157	-0.131	0.253	0.905

Item Weights

	AM	AS	INT	OA	PC	PP	PRE
RAM_1	0.926	0.273	0.177	0.255	-0.118	0.285	0.620
RAM_3	0.922	0.345	0.107	0.234	-0.093	0.255	0.633
RAM_4	0.844	0.193	0.208	0.311	-0.056	0.360	0.497
RAS_2	0.259	0.909	-0.280	-0.226	-0.239	0.074	0.274
RAS_3	0.330	0.940	-0.308	-0.212	-0.326	0.011	0.244
RAS_4	0.260	0.934	-0.217	-0.230	-0.332	-0.039	0.240
RI_1	0.160	-0.262	0.804	0.500	0.146	0.252	0.162
RI_2	0.233	-0.200	0.887	0.558	0.102	0.411	0.176
RI_4	0.035	-0.275	0.804	0.461	0.231	0.353	0.085
ROA_1	0.151	-0.309	0.577	0.800	0.379	0.294	0.018
ROA_2	0.348	-0.110	0.359	0.781	0.289	0.363	0.276
ROA_4	0.250	-0.146	0.534	0.870	0.304	0.291	0.128
RPC_1	-0.179	-0.373	0.145	0.258	0.860	0.281	-0.208
RPC_2	-0.027	-0.200	0.186	0.392	0.886	0.361	-0.045
RPC_3	-0.076	-0.291	0.148	0.389	0.875	0.347	-0.110
RPP_2	0.333	-0.009	0.232	0.288	0.339	0.772	0.147
RPP_3	0.293	0.084	0.303	0.345	0.373	0.873	0.268
RPP_4	0.258	-0.017	0.457	0.343	0.296	0.913	0.223
RPRE_2	0.570	0.295	0.128	0.120	-0.032	0.312	0.902
RPRE_4	0.575	0.235	0.164	0.111	-0.237	0.128	0.885

Construct Validity and Reliability Statistics

	AVE	Composite Reliability	Cronbach's Alpha
AM	0.806	0.926	0.879
AS	0.860	0.949	0.919
INT	0.693	0.871	0.779
OA	0.669	0.858	0.754
PC	0.764	0.906	0.847
PP	0.730	0.890	0.823
PRE	0.819	0.931	0.889

Risk Response 3

Construct Cross-correlations with √(AVE) on the Diagonal

	AM	AS	INT	OA	PC	PP	PRE
AM	0.888						
AS	0.021	0.901					
INT	0.566	0.111	0.881				
OA	0.606	-0.135	0.669	0.938			
PC	0.268	0.015	0.399	0.333	0.871		
PP	0.480	-0.002	0.497	0.536	0.436	0.884	
PRE	0.645	-0.096	0.379	0.459	0.154	0.279	0.921

Item Weights

	AM	AS	INT	OA	PC	PP	PRE
RAM_1	0.890	-0.019	0.566	0.581	0.228	0.427	0.592
RAM_3	0.893	0.022	0.499	0.559	0.272	0.425	0.571
RAM_4	0.882	0.058	0.437	0.468	0.212	0.427	0.554
RAS_2	0.025	0.938	0.082	-0.141	-0.040	-0.040	-0.112
RAS_3	0.008	0.910	0.127	-0.120	0.074	0.035	-0.071
RAS_4	0.044	0.852	0.109	-0.021	0.063	0.078	-0.011
RI_1	0.544	0.103	0.887	0.594	0.239	0.401	0.358
RI_2	0.420	0.084	0.914	0.600	0.392	0.438	0.267
RI_4	0.537	0.106	0.842	0.574	0.416	0.474	0.378
ROA_1	0.556	-0.162	0.632	0.934	0.324	0.505	0.443
ROA_2	0.538	-0.074	0.591	0.934	0.267	0.477	0.384
ROA_4	0.607	-0.141	0.656	0.946	0.342	0.523	0.460
RPC_1	0.176	0.059	0.268	0.181	0.801	0.322	0.099
RPC_2	0.249	0.028	0.362	0.306	0.888	0.400	0.124
RPC_3	0.262	-0.033	0.395	0.355	0.920	0.409	0.170
RPP_2	0.351	-0.054	0.405	0.458	0.415	0.865	0.185
RPP_3	0.481	0.031	0.510	0.485	0.373	0.906	0.286
RPP_4	0.428	0.011	0.386	0.478	0.373	0.880	0.259
RPRE_2	0.576	-0.099	0.334	0.400	0.177	0.269	0.910
RPRE_4	0.576	-0.026	0.370	0.400	0.056	0.191	0.915
RPRE_5	0.626	-0.135	0.343	0.465	0.188	0.304	0.937

Construct Validity and Reliability Statistics

	AVE	Composite Reliability	Cronbach's Alpha
AM	0.789	0.918	0.867
AS	0.812	0.928	0.903
INT	0.777	0.913	0.856
OA	0.879	0.956	0.932
PC	0.759	0.904	0.842
PP	0.781	0.914	0.861
PRE	0.848	0.944	0.911

Conclusion

In managing IT projects, IT project managers have to make several decisions about enacting specific risk responses or executing the projects without doing so. In order to help them make better decisions, the past literature has offered various prescriptions (e.g., Boehm 1991). Nevertheless, the behavior of IT project managers has been found to be different from such prescriptions (e.g., Bannerman 2008). By adopting a behavioral perspective to managerial decision making about risk (March and Shapira 1987), this three-essay thesis focused on understanding IT project managers' actual decision making in this particular context.

Essay 1 did this by providing a set of decision-making assumptions that can be used when theorizing about this phenomenon. It suggested that three decision-making concepts about which prescriptions in the literature are different from the risk assessment and response behaviors of IT project managers are: (1) the objectivity of risk, (2) the relative importance of probability and magnitude dimensions of risk exposure, and (3) the determinants of risk-response decisions. After articulating normative and behavioral assumptions about these concepts, this essay offered various directions for future research.

Essay 2 contributed to our understanding of IT project managers' actual decision making by scrutinizing the determinants of preferring analytical or experiential risk assessment processes. It proposed that seven determinants for the use of experiential or analytical processes are: (1) having formal project management training, (2) experience (number of years of IT project management), (3) perceived cognitive resource demanded by process, (4) perceived process accuracy, (5) time into project, (6) perceived need for evidence-backed-up communication of risks, and (7) perceived need to comply with an analytical risk response mandate.

Essay 3 added to our understanding of IT project managers' actual decision making by further specifying the link between perceived risk exposure and risk response intentions of IT project managers. It suggested that the effect of perceived risk exposure on risk response intentions is indirect, mediated through overall risk response attitude. It examined three specific risk responses: having user representatives as project team members, appreciating team members' work in a tangible way during the project, and dedicating much effort to planning. For these three risk response, this essay found support for the suggested mediation effect. It also found that perceived pressure for or against risk responses is an influential factor on risk response intentions of project managers. Additionally, it found some mixed support for the influence of perceived control.

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