

Navigating Risk in Agile Projects: An Empirical Investigation into the Influence of Risk Tolerance and Experience

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Introduction

In the dynamic landscape of project management, risk management has emerged as a vital determinant of project success projects (PMI, 2021; Olechowski, Oehmen, Seering, & Ben-Daya, 2016). It underscores the structure of effective project management, playing a central role in steering projects towards their objectives (Khatib, 2022). Its influence extends beyond individual projects to shape the performance of entire portfolios (Teller & Kock, 2013), highlighting its strategic value. Despite its acknowledged importance, the effectiveness of risk management often falls short in practice. This shortfall is particularly noticeable in the realm of agile projects (Wet & Visser, 2013). The adoption and implementation of risk management practices in software projects and agile methods are reportedly low (Niazi, et al., 2016; Chaouch, Mejri, & Ghannouchi, 2019). This discrepancy between risk management's theoretical significance and its practical application raises critical concerns, as it can directly contribute to the failure of agile projects.

The adoption of agile methods has been steadily increasing due to its potential to increase the likelihood of success in software development projects (Stettina & Hörz, 2015; Lopez-Nores, et al., 2016; Sithambaram, Nasir, & Ahmad, 2021; Schwalbe, 2018; Serrador & Pinto, 2015). Agile methods have proven beneficial in accelerating the time-to-market, improving quality and productivity, and aligning information technology initiatives with business objectives (Qumer & Henderson-Sellers, 2008; Jyothi & Rao, 2011; Nishijima & Dos Santos, 2013; Mishra, Abdalhamid, Mishra, & Ostrovska, 2021).

These advantages make agile an attractive choice for projects operating in a fast-paced, competitive environment. However, a significant limitation of agile methods is

their lack of explicit risk management activities (Serrador & Pinto, 2015; Alharbi & Qureshi, 2014; Tomanek & Juricek, 2015; Bumbary, 2016; Chaouch, Mejri, & Ghannouchi, 2019). The process of managing risk in agile projects often occurs implicitly, rather than as a distinct, well-defined set of activities (Walczak & Kuchta, 2013; Siddique & Hussein, 2014; Albadarneh, Albadarneh, & Qusef, 2015; Tavares, Silva, & Souza, 2017; Chaouch, Mejri, & Ghannouchi, 2019). This gap in the agile methodology can lead to missed opportunities for proactive risk mitigation and potentially compromise a project's success.

Notably, agile methods possess inherent resources that contribute to risk management; however, the effectiveness of risk management is influenced by the experience of team members (Tavares, Silva, & Souza, 2017). The reuse of agile methods is crucial as they are empirical and evolve based on the team's experience. Team experience in risk management significantly affects outcomes, with agile methods yielding superior results in teams with extensive risk management experience. Conversely, traditional methods prove more effective in less-experienced teams due to their explicit risk management activities and prescribed implementation steps (Tavares, Silva, & Souza, 2017).

In light of these insights, this paper ventures beyond the traditional focus on team experience to explore the potential impact of team risk tolerance on the effectiveness of risk management in agile projects. Risk tolerance refers to the team's willingness to accept risk, which can vary significantly among individuals and teams. Therefore, by examining this variable alongside experience, we aim to offer a more comprehensive understanding of the factors influencing risk management in agile contexts. To accomplish this, we invited 72 participants with varying risk tolerance profiles and experience in risk management and agile methods to partake in an empirical investigation. Through this study, we hope to highlight the complex interplay between risk tolerance, experience, and risk management effectiveness.

Literature Review

Since we seek to delve into the crucial aspects of risk management within agile methods, we focus on the role of team experience and risk tolerance. As such we begin our review of pertinent studies by critically evaluating and contextualizing existing

practices of risk management in agile methodologies. In this vein, we consider the strengths and limitations of these practices, highlighting the implicit nature of risk management within agile and the potential deficiencies this brings. Subsequently, we examine the critical role of team dynamics in agile projects, particularly in relation to risk management. This discussion underscores the importance of team experience in effectively managing risks in an agile context. Ensuing this, we introduce the concept of risk tolerance and highlight its relevance within the context of agile projects. This underscores the influence of risk tolerance on decision-making and project performance, drawing from existing research.

Agile Teams and Risk Management

In the agile context, individuals and their collaboration play a particularly significant role. The Agile Manifesto emphasizes the importance of motivated individuals, advocating for their autonomy and providing them with the necessary environment and support to accomplish their tasks (Beck, et al., 2001). Agile teams, thus, possess substantial independence and foster a culture of innovation, empowering members to make decisions autonomously (Oyetoyan, Cruzes, & Jaatun, 2016). This decentralized decision-making approach, along with the shared leadership model, grants agile teams substantial control over project execution and the implementation of agile practices (Nerur, Mahapatra, & Mangalara, 2005; Stettina & Hörz, 2015).

The self-organizing nature of agile teams is considered a critical driver of success in agile projects (Chow & Cao, 2008). It directly impacts team effectiveness by decentralizing decision-making authority, thereby enhancing the speed and precision of problem-solving (Moe & Dingsøyr, 2008). Given this approach, the onus of identifying and prioritizing risks rests on every member of the agile team (Nelson, Taran, & Hinojosa, 2008). However, despite this responsibility, agile teams generally refrain from employing specific risk management approaches (Chaouch, Mejri, & Ghannouchi, 2019). Consequently, the effectiveness of risk management in agile projects ultimately hinges on the team's collective experience with managing risks (Tavares, Silva, & Souza, 2017).

Risk tolerance profile in Agile projects

Risk tolerance, often referred to as risk-propensity or risk-taking tendency, is an individual's inclination towards embracing or avoiding risks (Sitkin & Pablo, 1992; Sitkin & Weingart, 1995). It captures the acceptable outcomes that result from deviations in expectations, as agreed upon by stakeholders (Bateman, Maritime, & Wallace, 2015). The concept of risk tolerance has been extensively researched in various fields, including finance, where it influences investment decisions (Yulianis & Sulistyowati, 2021; Nguyena, Galleryb, & Newton, 2019; Song, Pan, Ayub, & Cai, 2023; Mohta & Shunmugasundaram, 2023), and technology, where it impacts decision-making behavior and IT security effectiveness (Matschak & Pfaff, 2022; Feng & Wang, 2019).

In the context of project management, risk tolerance refers to the willingness to bear risk during a project, and tolerance management allows for the acceptance of such risks (Gupta & Govindarajan, 1982). An individual's risk-taking or risk-averse behavior can significantly influence decision-making under conditions of risk and uncertainty (Keil, Wallace, Turk, & Dixon-Randall, 2000). Risk tolerance can largely explain individual risk behavior (Das & Teng, 2001) and is considered an essential component of a high-performing project culture (Newman, 2015). Moreover, risk tolerance may positively impact software projects (Newman, 2015) and significantly influence risk management approaches (PMI., 2017).

In line with the Agile Manifesto (Beck, et al., 2001), agile teams, with their self-governing and cross-functional abilities, assume the responsibility for risk management in agile projects (Hoda, 2011; Schwaber & Sutherland, 2017). These teams are particularly skilled at identifying potential risks due to their diverse range of business and technical perspectives (Moran A. , 2016). They contribute to not only the development of plans but also the analysis of risks and obstacles (Muntés-Mulero, et al., 2019), thereby managing both business and technical risks (Tavares, Silva, & Souza, Practices to Improve Risk Management in Agile Projects, 2019). The experience of agile teams influences the application of agile methods, as these methods are empirical (Tavares, Silva, & Souza, 2017). However, the literature lacks research that examines the influence of the risk tolerance profile on the effectiveness of risk management in agile projects.

In essence, our review of the literature affords invaluable insights into the complex dynamics of risk management in agile projects. It highlights the importance of team experience in effectively navigating the unique challenges presented by agile methodologies, and given the inherent informality of risk management practices in agile, the team's collective experience can significantly determine the success of these practices. In conclusion, while literature provides a comprehensive understanding of the individual roles of team experience and risk tolerance in agile projects, it does not adequately address the interplay between these factors. This gap in the literature forms the basis of our research, as we aim to examine how team experience and risk tolerance collectively influence the effectiveness of risk management in agile projects.

Methodology

This study adopts an experimental approach, widely recognised for its ability to establish causal relationships between variables and outcomes. The methodology follows the structured framework proposed by Wohlin et al. (2000) and is organised into five key phases: *Experiment Scope*, which defines the problem and objectives; *Experiment Planning*, detailing the design; *Experiment Operation*, describing execution procedures; *Data Analysis and Interpretation*, outlining the statistical methods applied; and *Presentation and Packaging*, concerning the documentation of results (Figure 1).

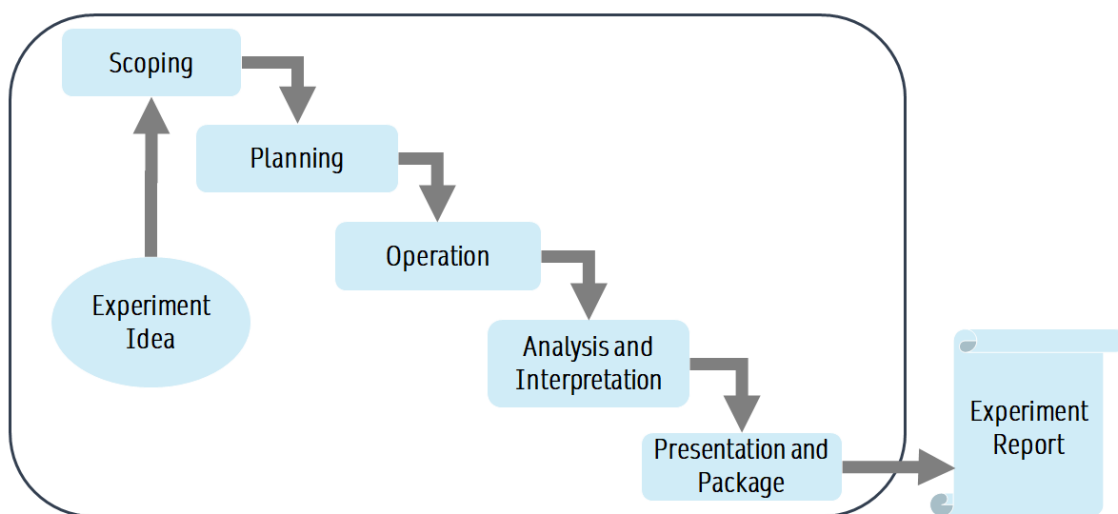


Figure 1. Experimental research process

Adapted from Wohlin et al. (2000)

Experiment Scope

The experiment scope establishes the foundational elements of the study, including the problem definition, research objectives, and context (Wohlin et al., 2000). These elements are summarised in Table 1.

Table 1 – Scope of the experiment

Definition	
Study object	Risk Tolerance Profile
Objective	To evaluate the influence of the risk tolerance profile on the effectiveness of risk management in agile projects
Qualitative focus	Effectiveness of risk response planning
Perspective	Based on assessments from Scrum Masters involved in the original projects
Context	Involvement of 72 professionals with experience in international agile software projects

The sample comprised 72 participants, a number aligned with empirical research standards in engineering and software development. According to Kitchenham and Charters (2007), sample sizes between 30 and 75 are typically sufficient for achieving statistical validity in controlled experiments, particularly when combined with random assignment and control procedures. Similarly, Wohlin et al. (2012) highlights that empirical software engineering studies can produce reliable and generalisable results even with moderately sized samples, provided the study design ensures rigour and replicability.

This study focuses on evaluating risk response planning within the broader context of risk management. This focus was chosen due to several critical characteristics: (i) it is essential to the overall success of risk management as it facilitates the prevention and mitigation of risks through appropriate strategies (Fan, Li & Zhang, 2015); (ii) it has a direct impact on project outcomes (Mousavi et al., 2011); (iii) it is often overlooked in practice (et al., 2009); and (iv) there is limited availability of effective tools to support risk response planning in the literature (Saari, 2004).

Experiment planning

The planning phase defines the experimental framework, including hypotheses, variables, and procedures (Wohlin et al., 2000). These elements are summarised in Table 2.

Table 2 –Variables and Hypotheses

Types	Variables	Hypotheses
Independent	Experience	Experience in agile and risk management influences the quality of risk response planning.
	Risk Tolerance	The participant's risk tolerance profile affects risk management effectiveness.
Dependent	Risk Management Effectiveness	H0e: Risk-averse individuals are more effective than others.
		H1e: Risk-seekers are less effective than neutrals.
		H2e: Experienced professionals are more effective than less experienced ones.
Dependent	Time Spent	H3e: Moderately experienced professionals outperform those with little experience.
		H0t: Risk-averse participants take more time to plan responses.
		H2t: Risk-neutral participants take more time than risk-seekers.
		H3t: Risk-seeker participants take less time than others.

Figure 2 summarizes the experiment's input, results, noise, and control factors.

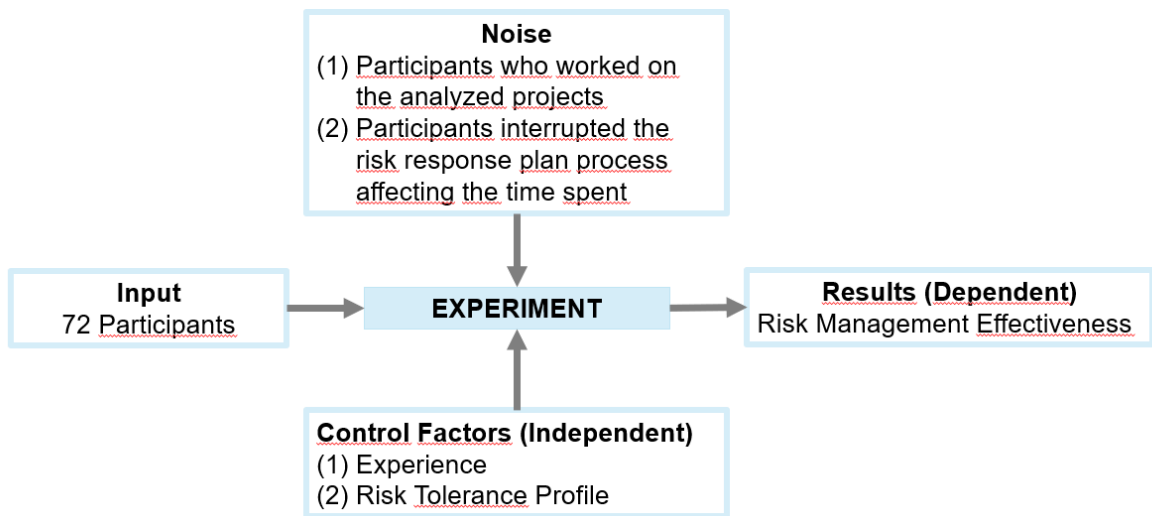


Figure 2. Experimental factors: inputs, results, noise, and control

Adapted from Montgomery (2013)

To minimise the influence of confounding factors, we implemented several control measures: (i) participants with prior involvement in Projects A or B were excluded to avoid bias

from previous knowledge; and (ii) a timing system with pause/resume functionality was introduced to ensure accurate tracking of the time spent on planning tasks, allowing for interruptions without compromising data integrity.

This experiment employs the Design of Experiments (DOE) methodology, a systematic approach commonly applied in engineering to enhance the robustness of empirical studies (Firka, 2011). DOE facilitates the identification of influential variables and the optimisation of data collection procedures (Nobahar, Mojib & Moharrami, 2015). In this study, two key independent variables were identified: participants' experience with agile methods and their risk tolerance profile. Both factors were considered critical to interpreting variation in performance outcomes. Table 3 presents the participant distribution.

Table 3 – Participant distribution by experience and risk tolerance profile

Participants	Experience ¹	Risk tolerance profile ²
8	Little	Averse
8	Little	Neutral
8	Little	Seeker
8	Average	Averse
8	Average	Neutral
8	Average	Seeker
8	Much	Averse
8	Much	Neutral
8	Much	Seeker

Results

The authors plan to advance this research by applying a comprehensive set of statistical techniques to the existing experimental dataset. While the current study has primarily focused on the methodological framework and preliminary qualitative insights, the subsequent phase will involve the structured application of descriptive statistics, MANOVA (Multivariate Analysis of Variance), and ANOVA (Analysis of Variance) to examine statistically significant differences between participant groups. These methods will facilitate a more nuanced understanding of how varying levels of experience and differing risk tolerance profiles influence the effectiveness of risk response planning within Scrum-based contexts.

¹ Experience: Little (Less than 1 year), Average (From 1 to 3 years), Much (Beyond 3 years)

² Risk tolerance profile: Averse (Want to avoid or reduce risk), Neutral (Between averse and seeker), Seeker (Comfortable to take risks)

Further analytical refinement will be pursued through variance analysis and coefficient analysis, aiming to identify the variables that most significantly affect planning efficiency and decision-making accuracy. The outcomes of these analyses will inform the development of predictive models and generate actionable insights for Scrum teams seeking to enhance their risk management practices. Adhering to the principles of Design of Experiments (DOE) will ensure methodological rigour and reproducibility, thereby contributing meaningfully to the empirical knowledge base of agile risk management.

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