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Research Report

Determinants and Consequences of Decision Errors in Innovation Development: A Comprehensive Empirical Investigation on the Organizational and Individual Level

Suggested Citation: Schuhmacher, Monika C. (2025) : Determinants and Consequences of Decision Errors in Innovation Development: A Comprehensive Empirical Investigation on the Organizational and Individual Level, ZBW - Leibniz Information Centre for Economics, Kiel, Hamburg

This Version is available at:

<https://hdl.handle.net/10419/318550>

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FINAL REPORT

1 General Information

DFG reference number: SCHU 2938/3-1

Project number: 463387112

Project title: **Determinants and Consequences of Decision Errors in Innovation Development: A Comprehensive Empirical Investigation on the Organizational and Individual Level**

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Name(s) of the cooperation partners: Dr. Kumar R. Sarangee, Dr. Petrit Ademi

Reporting period (entire funding period): September 1, 2021 – August 31, 2024

2 Summary

2.1 English summary

This DFG project addressed the research question of how specific decision errors in innovation endeavors occur and subsequently influence individual and organizational behavior. The phenomena under scrutiny comprise innovation failure and missing out on an innovation opportunity. While the former results from pursuing an inherently bad project, the latter results from not pursuing an inherently good project further. Focusing on these distinct decision errors, particularly the latter, three empirical subprojects fill relevant research gaps and help to formulate implications for scholars and practitioners.

Subproject 1 investigates how erroneous project abandonment can occur through a stepwise process. The results show that the type of innovation project has implications for the uncertainty innovation project decision-makers perceive, thus determining their use of specific information-processing modes for project evaluation and decision-making. The employed information-processing modes affect the quality of an abandonment decision and, by extension, the likelihood of missing out on a valuable innovation opportunity. **Subproject 2** examines how organizations respond to missing out on capturing an initially considered, innovation-related investment opportunity, i.e. merger and acquisitions. Preliminary results show that the amount of subsequent spending in similar investment decision situations depends on whether an organization previously missed out on further pursuit or not. **Subproject 3** examines how recently experienced decision errors influence decision-makers' persistence with a currently underperforming innovation project. The results show that the willingness to persist with an underperforming innovation project depends on the type of decision error committed. In addition, the focal effect is contingent upon decision-makers' self-regulatory ability. The results of all three subprojects help to formulate implications for practitioners. In particular, they help to sensitize practitioners to the occurrence and effects of innovation decision errors.

2.2 German summary

Das vorliegende DFG-Projekt adressiert die Forschungsfrage wie spezifische Entscheidungsfehler in innovationsbezogenen Vorhaben entstehen und nachgelagertes organisationales und individuelles Verhalten beeinflussen. Die untersuchten Phänomene umfassen hierbei einen Innovationsfehlschlag und das Verpassen einer Innovationsmöglichkeit. Während Ersteres aus dem Verfolgen eines inhärent schlechten Projektes entsteht, entsteht Letzteres aus dem Abbruch eines inhärent guten Projektes. Drei

Teilprojekte fokussieren sich auf diese Entscheidungsfehler, füllen in diesem Zuge relevante Forschungslücken und erhöhen das akademische und praktische Verständnis.

Teilprojekt 1 untersucht, wie ein fehlerhafter Projektabbruch auf Basis eines schrittweisen Prozesses entstehen kann. Die Ergebnisse zeigen, dass der Innovationsprojekttyp die Wahrnehmung von Unsicherheit durch Entscheider:innen beeinflusst und damit deren Informationsverarbeitungsstil für die Projektevaluation und das Treffen von Projektentscheidungen. Der Informationsverarbeitungsstil beeinflusst nachgelagert die Qualität einer Abbruchentscheidung und damit die Wahrscheinlichkeit, eine potenziell wertvolle Innovationsmöglichkeit zu verpassen. **Teilprojekt 2** untersucht, wie Organisationen auf das Verpassen einer betrachteten, innovationsähnlichen Investitionsmöglichkeit, spezifische Merger & Akquisitions-Möglichkeit, reagieren. Die Ergebnisse zeigen, dass die Höhe der Investitionssumme in nachgelagerten Entscheidungssituationen davon abhängt, ob eine Organisation die initiale Investition verpasst hat oder nicht. **Teilprojekt 3** untersucht, wie kürzlich begangene Entscheidungsfehler Persistenz mit einem momentan schlecht laufenden Innovationsprojekt beeinflussen. Die Ergebnisse zeigen, dass die Wahrscheinlichkeit einer weiteren Projektweiterverfolgung von der Art des begangenen Entscheidungsfehlers abhängt. Darüber hinaus hängt die Stärke dieses Effektes zusätzlich von der Fähigkeit zur Selbstregulation der Entscheider:innen ab. Die Ergebnisse aller drei Teilprojekte helfen dabei, praxisrelevante Empfehlungen zu formulieren. Insbesondere ermöglichen sie, Praktiker:innen hinsichtlich der Entstehung und Effekte von Innovationsentscheidungsfehlern zu sensibilisieren.

3 Progress Report

3.1 Background and objectives of the project

High-stakes decision-making usually takes place under conditions of severe uncertainty. Under these conditions, decision errors occur frequently and can put decision-making entities in an adverse position relative to their peers. Innovation development is a particularly relevant high-stakes decision context, as it represents a crucial organizational endeavor that separates winners from losers in today's hypercompetitive environments. Unfortunately, decision-making entities often struggle to pursue the "right" innovation opportunities. For example, only 26% of executives feel capable of stopping bad ideas at the right time, while 50% state that not enough good ideas even advance to commercialization (Capozzi et al., 2010). Whereas the former indicates a high percentage of erroneous pursuit decisions (synonyms include Type 1 errors, false positives, or commission errors), the latter implies erroneous abandonment decisions

(synonyms include Type 2 errors, false negatives, or omission errors) (e.g., Garud et al., 1997; Klingebiel, 2018). Both types of decision errors only reveal themselves after commercialization. While an erroneous pursuit manifests as a *failed innovation*, erroneous abandonment corresponds with a *missed innovation opportunity* indicated by successful preemption through a rival organization (e.g., Klingebiel et al., 2022). Notably, scholars emphasize that both errors are costly (Csaszar, 2013) and reduce organizational performance in distinct ways (Kumar and Operti, 2023). However, research investigating how failed innovations and missed innovation opportunities occur and subsequently affect the behavior of individuals and whole organizations remains scarce. This observation is especially true for the latter of the two phenomena.

This project's overarching objective has been to address this prevailing scarcity and, thus, answer recent calls for research (e.g., Rindfleisch et al., 2020). Specifically, the project addresses the overarching research question of how specific decision errors in innovation-related endeavors occur and subsequently influence individuals and organizations. The central assumption is that decision errors occur at the level of the project or endeavor and shape organizational and individual behavior and decision-making in distinct ways after their occurrence. Three individual subprojects across different levels of analysis (i.e., project, organizational, and individual) employ diverse empirical methods and help to derive theoretical and practical implications.

3.2 Deviations from and adjustments to the original project concept

3.2.1 Original project concept and planning

While fundamentally anchored in prior innovation decision-making, strategy, and organizational research, the original research questions were primarily based on the theoretical assumptions of organizational information processing theory and the behavioral theory of the firm, i.e., behavioral decision-making, respectively (see Table 1).

Table 1: Original theories proposed and corresponding research questions	
Organizational information processing theory	• RQ1: Which organizational information processing-related factors determine decision errors in innovation development?
Behavioral theory of the firm and behavioral decision-making	• RQ2: What are the behavioral and performance-related consequences of decision errors in innovation development for organizations?

	• RQ3: How can organizations balance decision errors in innovation development effectively and achieve an expedient decision error proportion? • RQ4: What are the effects of decision errors on individuals' emotional and behavioral responses under the consideration of specific contingency factors?
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RQ1-RQ4 were to be addressed in three corresponding subprojects:

- Subproject 1 [situated on the organizational level]: Organizational determinants of decision errors in innovation development from an organizational information processing perspective (RQ1)
- Subproject 2 [situated on the organizational level]: The effects of decision errors on organizational behavior and subsequent performance (RQ2 and RQ3)
- Subproject 3 [situated on the individual level]: The effects of decision errors on individuals' emotions, decision-making, and behavior (RQ4)

To answer the original research questions, several empirical methods were to be used. First, the original plan was to complement already collected survey data with an additional online experiment for subproject 1. Second, expert interviews were to be combined with survey data in subproject 2. Lastly, it was planned to conduct two online experiments for subproject 3.

3.2.2 Adjustments to the original project concept.

We adjusted the original project concept over time (see Table 2) without losing sight of the overarching goal and research question.

Table 2: Final theories employed and corresponding research questions	
Exploitation-exploration paradigm, uncertainty theory, information processing	• RQ1: How does the type of innovation project affect the occurrence of missed innovation opportunities?
Behavioral theory of the firm and behavioral decision-making	• RQ2: What are the behavioral consequences of decision errors in innovation development for organizations? • RQ3: What are the effects of decision errors on individuals' behavioral responses under the consideration of specific contingency factors?

Again, we addressed RQ1-3 in three subprojects:

- Subproject 1 [situated on the innovation project level]: Project-level determinants of missed innovation opportunities (RQ1)
- Subproject 2 [situated on the organizational level]: The effects of missed innovation opportunities on organizational behavior (RQ2)
- Subproject 3 [situated on the individual level]: The effects of decision errors on individuals' decision-making and behavior (RQ3)

In the following, we will describe the adjustments to the original project concept in more detail.

Regarding **subproject 1**, we submitted the original manuscript to a top peer-reviewed innovation journal (VHB ranking: A). At this point, the manuscript addressed the initial research question derived from organizational information processing theory (e.g., Tushman and Nadler, 1978) (see Table 1, RQ1). In the decision letter (major revision), however, reviewers suggested collecting new data, changing the level of analysis from an organizational perspective to a single innovation project perspective, and a theoretical repositioning. Following these suggestions, we collected new survey data from innovation project decision-makers while adapting the original variables to the new setting. Specifically, we focused on a processual view of abandonment error occurrence on the project level during this iteration for two reasons. First, the type of innovation project (exploitative vs. exploratory) as a contextual determinant of project evaluation and decision-making approaches (intuitive vs. rational information processing) and, by extension, (erroneous) decision outcomes is neglected by previous research (Long et al., 2020). Second, past empirical innovation research has focused on erroneous pursuit decisions (Markovitch et al., 2015), leaving a blind spot regarding erroneous abandonment and, thus, missed innovation opportunities. Overall, the reviewers' suggestions and new possibilities to contribute to previous innovation research led us to adapt subproject 1 and its research question (see Table 2, RQ1), respectively.

Adjustments regarding **subproject 2** primarily concern the approach to data collection and the dropping of the initial RQ3 (see Table 1). Instead of conducting multiple interviews and an additional survey to investigate the consequences of decision errors on the organizational level, we decided to collect objective data via Refinitiv Eikon that allows for observing actual decision-making and behavior. Specifically, we chose mergers and acquisitions (M&As) as our research setting. Indeed, M&As reflect a means through which firms seek to access innovation (Zhao, 2009). Likewise, M&As share typical characteristics of innovation investments. For example, these large-scale investment decisions take place under uncertainty, as it is not clear from the

beginning whether they will turn out a success or failure (see Guler, 2018). Furthermore, using M&As allows for novel ways to operationalize decision errors in competitive situations.

For **subproject 3**, we opted to conduct a comprehensive online conjoint experiment instead of two scenario-based experiments. Conjoint experiments are particularly suitable to model complex decision-making processes such as innovation project decision-making, as they allow accounting for several relevant decision attributes and heterogeneity among decision-makers. As such, we deemed a conjoint experiment particularly suitable to cover the intricacies of innovation development in realistic fashion. However, conjoint analyses focus on the investigation of direct and moderating effects. Therefore, we had to make a trade-off and drop the investigation of emotions as a potential mediating force.

3.3 Project-specific results and findings

Subproject 1 examines how the type of an innovation project serves as the trigger for a stepwise process that can result in an increased likelihood of missing out on a valuable innovation opportunity. Initiated innovation projects can be either exploitative or exploratory by nature (Salge et al., 2013), i.e., use or depart from existing organizational knowledge to develop new products or services (Levinthal and March, 1993). We find that innovation decision-makers dealing with exploratory projects perceive a higher level of uncertainty than their counterparts. Consequently, they rely more heavily on an intuitive innovation processing mode compared with a rational information processing mode for project evaluation and decision-making. However, this tendency can backfire, as the results show that more extensive use of intuition decreases the quality of an abandonment decision, while a more extensive use of rationality expediently increases it. This insight is important, since we also find that a higher quality of an abandonment decision reduces the possibility of suffering a missed innovation. Considering the above-mentioned findings, we inform the discussion on the relationship between decision errors and exploitation-exploration (e.g., Csaszar, 2013). We also add to the innovation project decision-making literature by showing how erroneous abandonment decisions can occur, going beyond the usually researched erroneous continuation decisions (e.g., Eliëns et al., 2018).

Preliminary results of subproject 2 show that organizations that miss out on capturing an innovation-related investment opportunity subsequently spend more in similar decision situations than rivals that do not miss out. Specifically, the amount of subsequent M&A spending in the year following a merger or acquisition decision is higher for organizations that withdrew from a deal than for those that completed a deal involving multiple bidders. In addition,

we test for moderating effects by further examining the perceived quality of M&A announcements. This involves evaluating whether the initial announcement was perceived favorably or unfavorably by the market, as indicated by above-average or below-average cumulative abnormal returns, respectively. Our findings reveal that pursuing an unfavorably perceived announcement (i.e., pursuing a bad project) leads to less subsequent spending than withdrawing from a favorably perceived announcement (i.e., not pursuing a good project). These insights contribute to the literature on behavioral decision-making by empirically showing decision errors affect the allocation of financial resources (Klingebiel, 2018). Moreover, we answer calls for research regarding the investigation of the behavioral consequences of withdrawing from M&A deals (Welch et al., 2020).

Subproject 3 finds that recent decision errors affect the likelihood of persisting with a currently underperforming innovation project. Specifically, a recent missed innovation opportunity leads to a higher likelihood of persistence than a failed innovation project. This effect holds even when controlling for previous resource investment, rate of project completion, and project innovativeness, which all reflect established and impactful traditional persistence drivers and refer to crucial decision attributes of the underperforming innovation project under consideration. We also account for decision-maker heterogeneity by examining factors related to individual self-regulation and cognition. Interestingly, action-oriented decision-makers, i.e., individuals that are able to expediently follow their active intention after a negative experience and escape a passive state of excessive rumination, show an even stronger tendency to persist (not persist) after a missed innovation opportunity (failed innovation). In contrast, the differential effect of decision errors remains constant regardless of whether decision-makers process available information in-depth, demonstrating that a rational thinking style does not help to discount the past and shift the decision-making focus solely to the present project. These insights extend the literature on how previous adverse experiences shape subsequent project decision-making (e.g., Shepherd et al., 2011) by making the explicit distinction between different types of decision errors. We also contribute to literature on behavioral decision-making by identifying self-regulation as a crucial contingency factor in the decision error-behavior relationship (Klingebiel, 2018).

The subprojects' resultant manuscripts are currently in different phases. The manuscript of subproject 1 is under review in the *International Journal of Innovation Management (VHB:B)*, while the manuscript of subproject 2 is in the phase of data analysis and will be submitted to the *Journal of Management (VHB: A)* once finalized. The manuscript of subproject 3 was revised after a reject from *Journal of Management Studies* and will shortly be submitted to the *Journal of Product Innovation Management (VHB: A)*. Furthermore, we presented and fruitfully

discussed intermediate results of these subprojects at (inter)national peer-reviewed conferences for manuscript improvement, including the Innovation and Product Development Management Conference (IPDMC) and the Annual Interdisciplinary Conference on Entrepreneurship, Innovation and SMEs (G-Forum).

3.4 Description of the handling of research data and data infrastructure used

Over the course of this DFG project, we collected new data via two online questionnaires (subprojects 1 and 2) and leveraged existing M&A data from the Refinitiv Eikon database (subproject 3). Regarding subprojects 1 and 2, the data provided by respondents are anonymous by nature, as we relied on the services of an online sampling firm (Dynata) for participant recruiting and data collection. All of our (raw) data are predominantly quantitative and, thus, contained in separate MS Excel files. We cleaned and preprocessed the raw data for data analysis, following conventional standards. Although our data are not sensible per se, we stored the data on a specific drive only accessed by the research team. No legal particularities apply. After publication of the manuscripts, we seek to make the data accessible via a suitable online repository, such as the university-wide database JLUdata.

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4 Published Project Results

4.1 Publications with scientific quality assurance

- Hofmann, Björn, Monika C. Schuhmacher, and Kumar R. Sarangee (2024), "Persistence with underperforming innovation projects after experiencing failure: A conjoint experiment," *Presented at the 31st IPDMC: Innovation and Product Development Management Conference*, Dublin, Ireland (June 5-7).
- Hofmann, Björn and Monika C. Schuhmacher (2023), "Project-related antecedents of abandonment error occurrence in innovation development," *Presented at the 30th IPDMC: Innovation and Product Development Management Conference*, Lecco, Italy (June 7-9).

4.2 Other publications and published results

- Hofmann, Björn, "Failing and Missing Out: An Empirical Investigation of Adverse Decision Outcomes in Organizational Innovation Endeavors," dissertation in progress, Justus Liebig University Giessen.

4.3 Patents (applied for and granted)

Not applicable.